THE JOURNAL OF GAS LIGHTING
WATER SUPPLY & SANITARY IMPROVEMENT

VOL. CVIII. No. 2429.] LONDON, NOVEMBER 30, 1909. [61ST YEAR. PRICE 6d.

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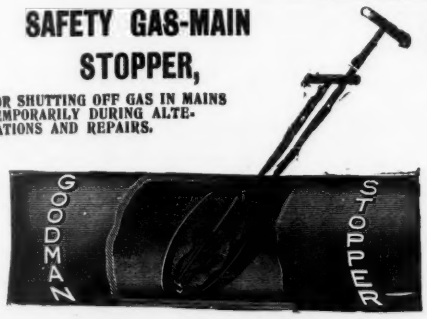

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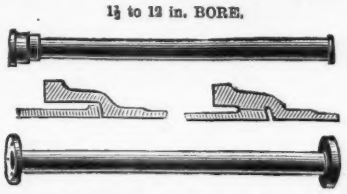

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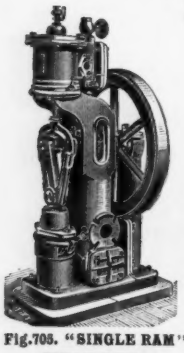

Fig. 703. "SINGLE RAM" STEAM-PUMP.

Fig. 598. "CORNISH" STEAM-PUMP FOR BOILER FEEDING, &c.

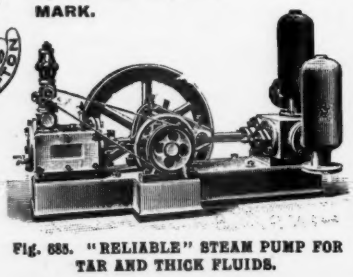

Fig. 685. "RELIABLE" STEAM PUMP FOR TAR AND THICK FLUIDS.

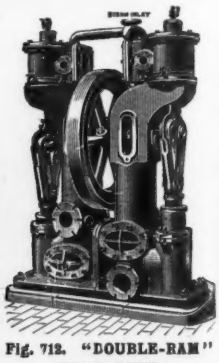

Fig. 712. "DOUBLE-RAM" STEAM-PUMP.

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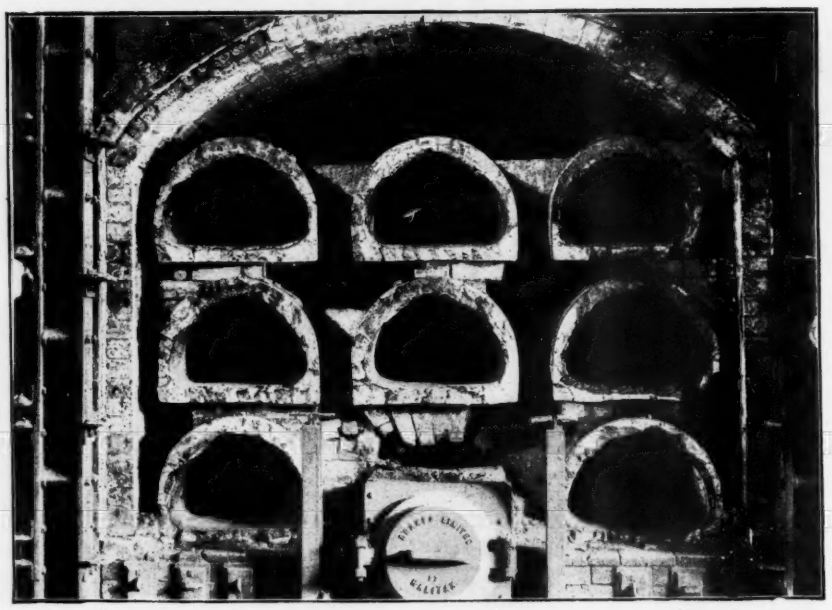

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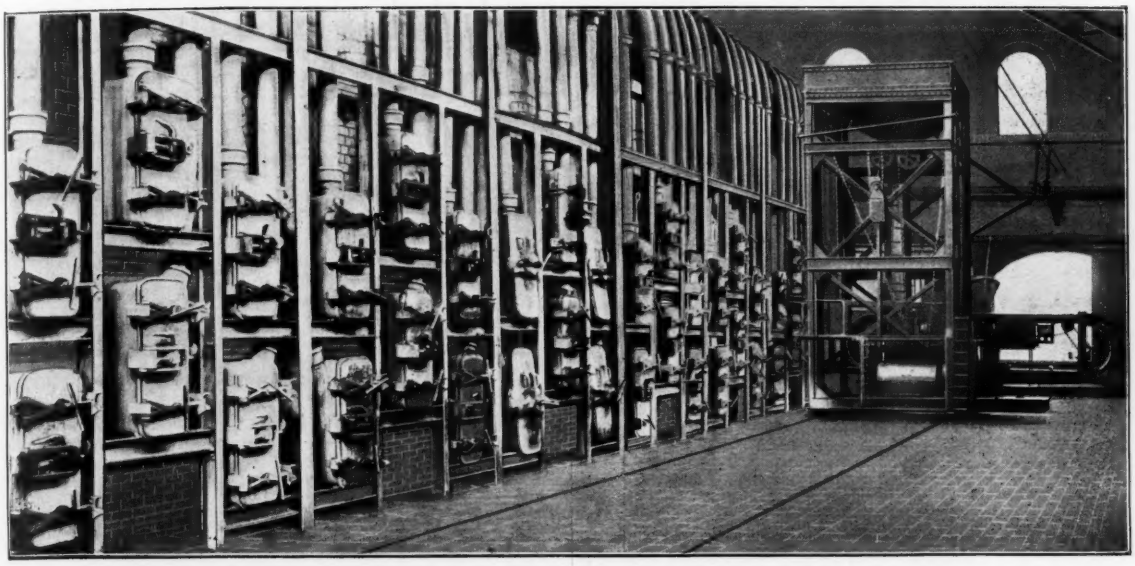

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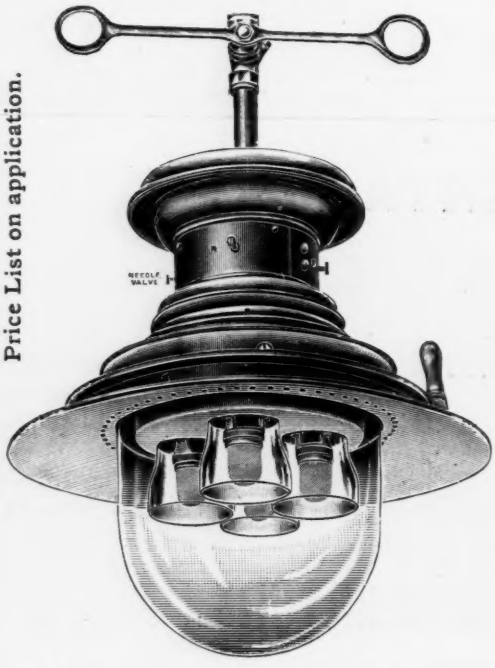

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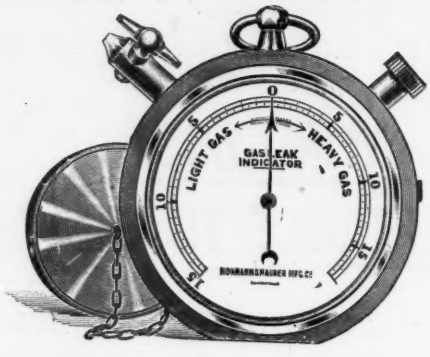

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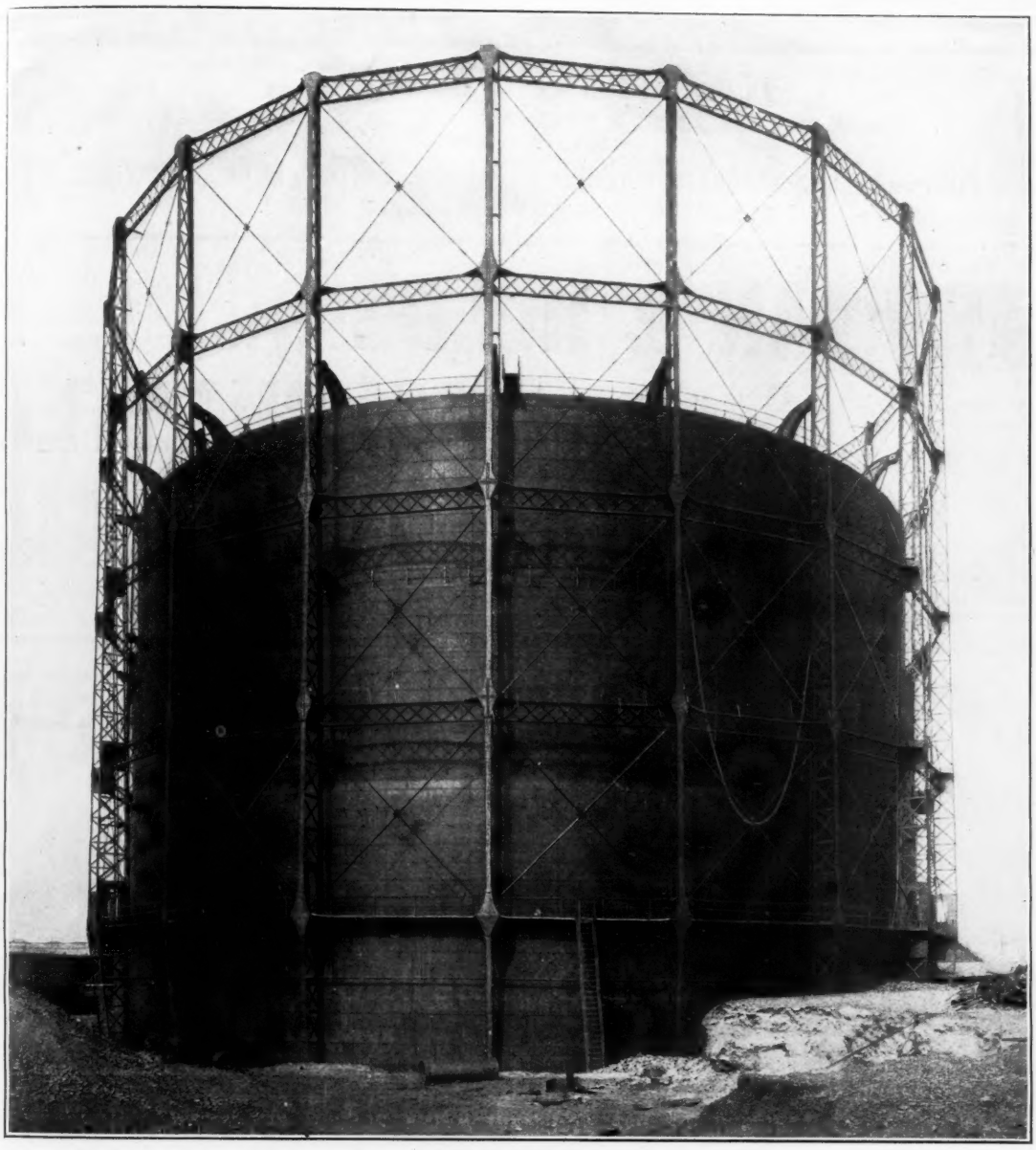

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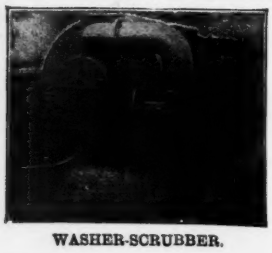
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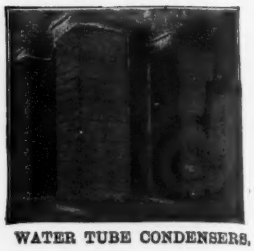
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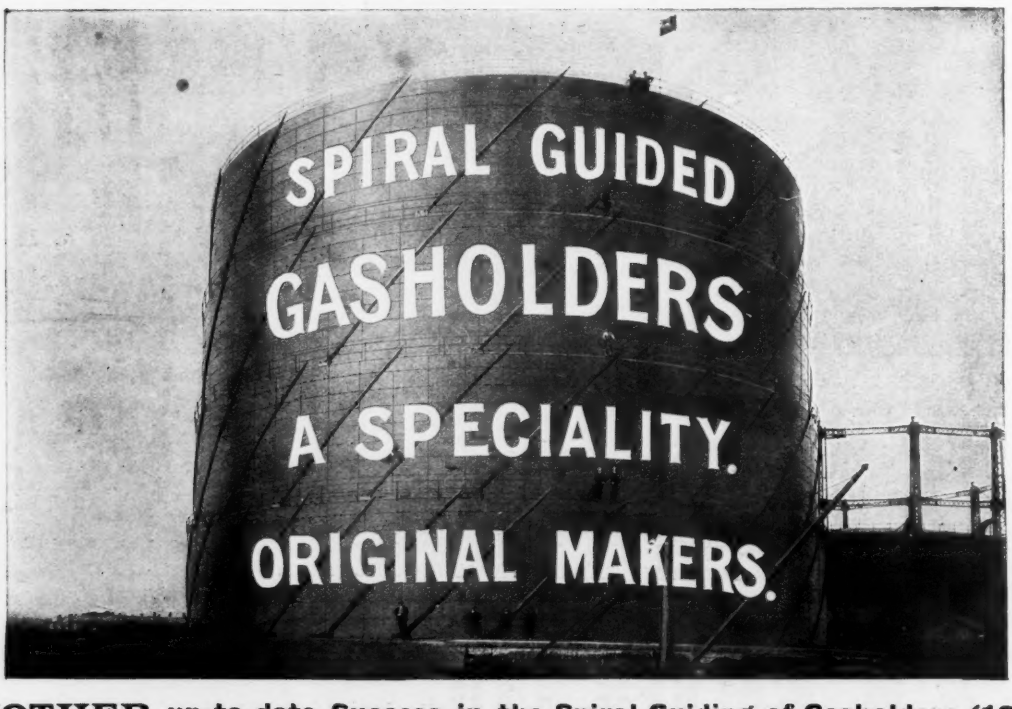

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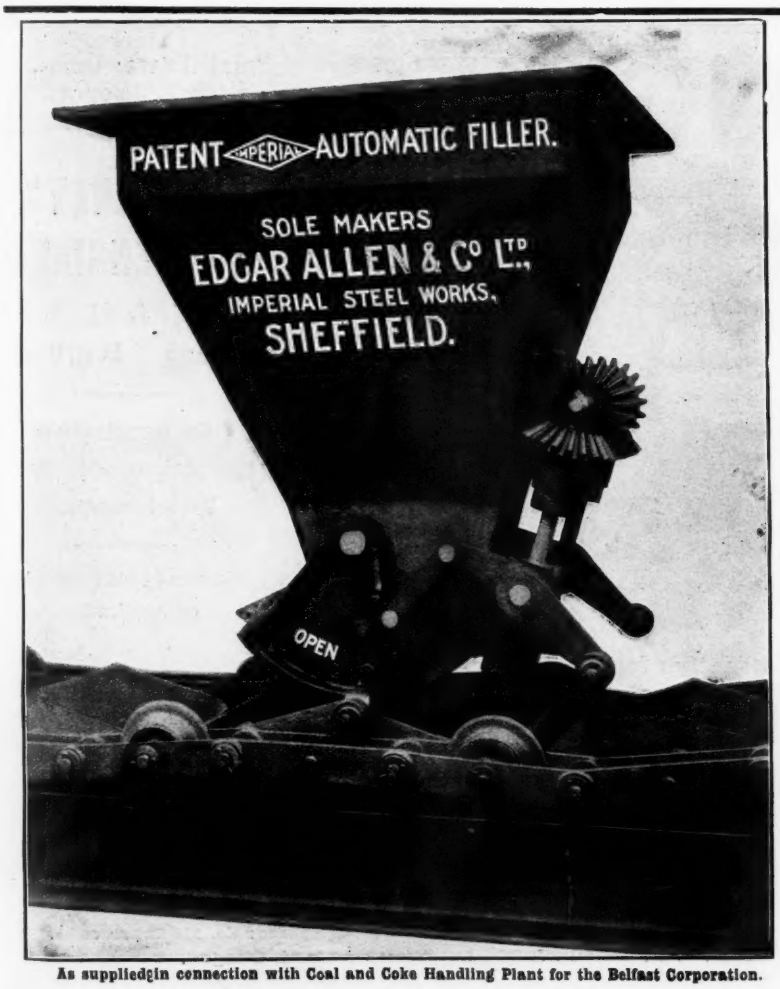

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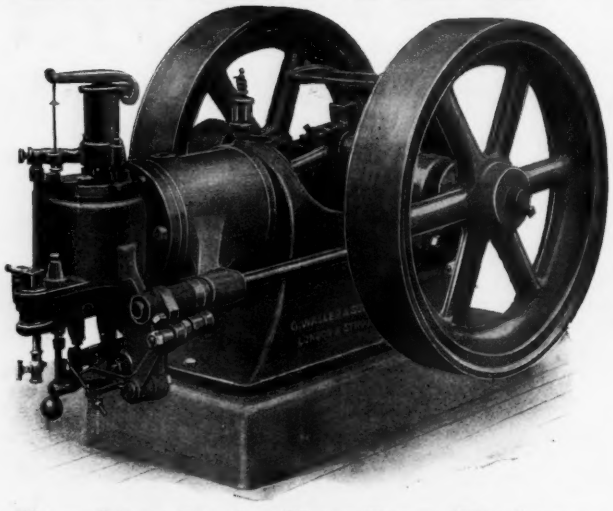

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EDITOR & PUBLISHER: WALTER KING. OFFICE: 11, BOLT COURT, FLEET ST., LONDON.

VOL. CVIII., No. 2429.—TUESDAY, NOVEMBER 30, 1909.

EDITORIAL NOTES—GAS, &c.

Gas Legislation in the Next Session.

THERE will be keen inspection in many quarters of the epitome of the notices which we publish this week, foreshadowing the plans in the matter of gas legislation in the next session of Parliament. Neither in number nor in quality (save in three or four instances) do the promised Bills and Orders present any variation from the almost monotonous tale of recent sessions. Dealing first of all with the notices of Bills, there are 29 that treat wholly or in part of gas—eighteen emanating from companies and eleven from local authorities; but certain of the latter will merely contain customary and uncontroversial clauses. In both company and local authority notices, illuminating power and testing are frequently mentioned; and a good proportion of the announcements portend that modern power investiture is the sole object of application. Outstanding from all others in interest will be the Gas Companies' Standard Burner Bills, which were remarked upon in last week's issue. The most substantial Companies to be before Parliament with Bills will be the Brighton and the Bristol. Both cases, in addition to financial matters, will deal with the questions of illuminating power and testing. The Bristol Company will also request relief from the sulphur compounds absurdity—a request that Parliament has never refused since the sitting of Lord Rayleigh's Committee. Protection will also be asked by them in regard to stand-by provision where there is an independent supply of gas or an electric service. It is rather a matter for surprise that the notices do not indicate a larger application for this form of protection in view of the success of applications in the present session. But so far as the advertisements make disclosure, we only notice, in addition to the Bristol Company, a few indications of a desire to be allowed to make a minimum charge for stand-bys where a private service obtains.

Schemes for a fair amount of district development are shadowed in the notices. In some instances, these extensions will involve the purchase of small concerns or parts of distribution systems; and there will probably be in certain cases some difficulty in regard to existing rights. For example, there is the Shirebrook and District Gas Company, seeking to take in part of the uncultivated territory of the Mansfield Corporation and the Bolsover Gas Company. Warsop is one of the places sought to be empaled by the Shirebrook Company; and the Mansfield Corporation have unexercised powers of supply there. A little complexity is introduced by the Warsop District Council applying to the Local Government Board for powers to themselves supply gas that they have purchased in bulk. There are also companies with histories in Parliament, and companies which recall events. The Ammanford Gas Company are applying for powers for the extension of the limits of supply; and power is wanted to pay the purchase price of the Amman Valley Gas Company's property in debentures, preference shares, or other securities, as well as authority to take proceedings to ascertain the validity of the debentures of the Amman Valley Company, and to declare invalid all debentures or shares issued without payment in money. There is the Chipping Norton Gas and Electricity Company, who want to purchase part of the Mid-Oxfordshire Gas Company's plant, as well as the Chipping Norton electric light undertaking. The mention of the Mid-Oxfordshire Company takes the memory back a few sessions. Then there is the Gowerton Gas Company in Parliament—a concern the promotion of which did not strike the gas industry or ourselves at all favourably. Reminiscent, too, is the title of the Whitland Water and Gas Company. The experience in the current session of gas companies applying direct to Parliament for electricity powers is to be repeated in the coming one. Chipping Norton has already been mentioned; Farnham and Havant are others; and there is another immediately following. A pretty big—big for Essex—scheme of consolidation of interests is found in the notice of the Bishop's Stortford, Harlow, and Epping Gas and Electricity Company. This provides for the amalgamation of the Bishop's Stortford, Harlow and Sawbridgeworth, and Epping Companies; and the purchase of the Ongar, Newport (Essex), Much Hadlow, and Dunmow Companies. That will make a concern with a broad acreage for its district.

Turning to the Local Authority Bills, the outside authorities of Salford who were successful last year in inducing Parliament to put some control on the gas profits transferred by the Corporation to the relief of the borough rates, have not carried out their intention of applying for powers to give effect to the intention of Parliament, from which intention the Corporation beat a precipitate retreat. But the Corporation themselves are bringing forward their proposed gas powers again; and one may construe an intimation in the notice—to the effect that provisions are to be included with respect to the application of the revenue arising from the gas undertaking, and to the allocation of the profits—to mean that negotiations with the outside authorities have been successful in arranging matters. There will be no small interest to see what information the Bill itself will contain in respect of this particular affair. The Bradford Corporation are again seeking to purchase the private gas-works which their Bill rejected *in toto* by the ratepayers early this year provided for. The Egremont, the Hoyland Nether, and the Mallow District Councils are all casting eyes on the property of the local gas companies. In the case of the Mallow concern, the Company have also come forward with a notice for a Bill. The Little Hulton District Council have an interesting proposal in hand. They contemplate purchasing the distribution plant in their district belonging to the Salford Corporation and the Farnworth and Kearsley Gas Company, and to distribute coke-oven gas produced at the Earl of Ellesmere's collieries.

There are only twelve applications for Gas Provisional Orders; the largest applicants being the Sheffield and the Swansea Gas Companies. The former are seeking a reduction of the standard illuminating power, and the application of the "Metropolitan" No. 2 burner to the testing; and the latter are asking for an extension of area. There is only a single gas application to the Local Government Board; and that is the one from Warsop to which reference has been previously made. Among the notices under the Private Legislation Procedure (Scotland) Act, four applications are being made in connection with gas supply—Dunblane, Falkirk, Glasgow, and Kirkcaldy. There is notification in the three last-named concerning the illuminating power and testing of gas. It is a many-featured application that the Glasgow Corporation will make. Among other things, they will seek to supply gas for non-illuminating purposes.

Collapse of the Italian Strike.

THE hope entertained last week that the strike of gas workers in Italy was nearing a termination, and that the strain and waste occasioned by the disturbance were about to cease, unhappily was not fulfilled in the way anticipated; but it has ended by the process of a complete collapse, and the submission of the strikers to the Company's terms. The men rejected the new conditions offered to them; and on Thursday a ballot was taken, which resulted in 600 voting for continuing the strike, 300 against, and 800 did not record their vote. The figures—300 against, and 800 declining to vote—are significant. It may well be taken that a majority of the 800 were deterred from casting their vote in with the 300 more from fear than anything else. When the result was announced, the Company continued the firm attitude they have all along shown on this occasion, and gave the men to understand that, unless they signed the new conditions without delay, they would be permanently dismissed. Most of the men were no doubt originally willing, at the instance of their leaders (who, as a certain "order" in another column

indicates, are past-masters in the art of working upon the passions of these men), to try to extort further advantages from their employers. But a month's strike with much shortened income, and a precarious outlook, are, in such a case, chastening influences, together with the experience of the new spirit of firmness on the part of the Company. There was soon manifest an unwillingness on the side of the men to permanently lose their employment. And consequently on Friday and Saturday they were returning to work in large numbers—glad enough to be re-established on the Company's own conditions, which are not those under which the men were working when they ill-advisedly threw up their employment in the vain desire to create impossible—and, being impossible, unprecedented—conditions of labour. We deplore the loss, the waste, the anxiety that have ensued; but things had come to such a pass at the works that it was necessary the men should be shown, on the ground selected by themselves, that the Company intended to firmly and yet fairly manage their own affairs without dictation. The men have been deceived by their leaders; they have been deceived as to their own power; they have been deceived as to the length they could go in making demands on the Company. There will be many a regret among the men, if they are not less than human, when they have finally sobered down, and work is once more on a normal footing, that they rashly took the step they did. When, too, in the calmer moments they survey the acts of the past few weeks, it is to be hoped that at all events some of them—surrounded as they are by the evidences of consideration and goodwill on the part of their employers—will see, whether they confess it or not, how silly has been the position of themselves and their leaders. It is reported in another column that there has been temporary trouble from the coke men since their return to work; but this, it is believed, is merely transient. One bright feature of the strike has been the ready response from all quarters to requests for assistance, together with the wholesale application on the part of gas workers in this country and abroad for work on the excellent conditions offered by the Company. One other acknowledgment. During this period of stress and storm, the executive and staff officers of the Company have laboured and faced much danger in a self-sacrificing and fearless manner that cannot be too highly applauded and remembered.

Society of British Gas Industries—Words of Counsel.

Another excellent meeting—excellent both in interest and in the extent taken of the social opportunity—was recorded on Thursday last by the Society of British Gas Industries, which, year by year, as the President (Mr. Thomas Newbigging) tells us, progresses numerically, and which, as the President of the Institution of Gas Engineers (Mr. James W. Helps) readily acknowledges, has an inestimable value, apart from its own internal contribution to the work for the advancement of the gas industry's welfare, in the matter of co-operative relations with the central professional organization. The testimony from two such distinguished figures in the gas industry is gratifying. There is also another palpable fact that offers extreme interest to the observer; and it is the growing advantage that is taken for fraternization and meeting on common ground by the principals of the great firms constituting the side of the industry engaged, competitively, in manufacturing the plant and appliances needed by the producers and users of gas. Every year points to a strengthening that augurs well for the continued success of the Society. Composed as the Society is, it is preferable to have in the presidential chair men who are absolutely independent of the private commercial interest of members; and it is a satisfaction to find that men of distinguished position deem it an honour to occupy the office. Mr. Dugald Clerk, F.R.S., Sir George Livesey, and Mr. Thomas Newbigging, have so far tenanted the chair; and next year will witness the addition to this worthy opening of the presidential roll of the celebrated name of Mr. J. H. Balfour-Browne, K.C. His acceptance of the position is an honour to the Society; and the invitation that he should become the Society's President is a recognition of the high place that he occupies in relation to the gas industry at the Parliamentary Bar and in the Law Courts. His brilliant forensic abilities have been exercised—in a measure perhaps greater than can be claimed by any other legal luminary—in the advancement and defence of the interests of the gas industry in the places where the laws controlling and directing it are made and interpreted. Hearty greetings are in store for his appearance in the chair at the next meeting of the Society.

The Inaugural Address of Mr. Thomas Newbigging as President was delivered at the meeting of the Society early in the year; and there was a supplementary address on the present occasion. His holding of the office, no one will be more ready to admit than himself, has been a means to educational expansion for him personally. In no walk of life can we know much of our fellow-men pursuing other walks, though, maybe, diverging never so little from our own, without actual contact, and more particularly without actual contact collectively, so as to learn from a fairly representative whole. Broad as were a year ago Mr. Newbigging's sympathies with the manufacturers of, and contractors for, gas plant and appliances, these sympathies have been further broadened by the year of his presidency among them. He has, as it were, put himself in their shoes, and has scrutinized things from their point of view. It is an exercise that might well be followed by others, and especially by that "special variety of the genus engineer to whom" the President has "often yearned to offer a word of advice." He has now taken a very appropriate opportunity; and the source of the advice—a source that has become filled with the wisdom of experience through a long succession of years spent mainly in the service of the gas industry—is one that commands respect, and the emanating advice is such that it will have effect. There are engineers and engineers; and it is for each engineer to judge whether or not the spoken word is addressed to himself. In fine, the advice is, Let mutuality and justice preside over all dealings between engineer and contractors.

The engineer who makes mountains out of easily effaceable molehills, who on reparable trifles seeks to build personal aggrandisement before Committee or Directors, or who, with deliberate intention, buoys up his professional claims by the specifications, drawings, and estimates obtained, without open acknowledgment and recompense, from contractors—he is the engineer to whom Mr. Newbigging has addressed timely counsel. He asks, too, for fair and adequate consideration for the poor inventor; and the suppression of that despicable habit of those clever enough to practise it of picking other men's brains without suitable reward. The owner of the intellect that produces something new for the use and convenience of man, or that which improves the use, convenience, or product of something already existing, deserves full and material acknowledgment. And further in regard to invention, in his travels in America recently, Mr. Newbigging has kept the affairs of the gas industry under observation; and he has unhesitatingly come to the conclusion that, in comparison, our home gas plant manufacturers are maintaining the lead in the race. This is well; but if we are to continue to hold our own, there must be no slackening of alertness or of enterprise, and new ideas must be adopted, and old ones discarded. One respect in which Mr. Newbigging is especially satisfied to know that British inventors are not lagging behind in the race is in the development of carbonizing practice; and, in his opinion, the new system of carbonization in vertical retorts will have a steady and continuous growth in application. Of such subjects was the address composed; and no one will be sacrificing time by pausing awhile over them.

The Smoke Evil and the Gas Industry.

Those engaged in manufacture, and therefore possessing factories, and the factories having chimneys, and those engaged in the manufacture and sale of articles designed for the use of gaseous fuel, must be one and all interested in the great smoke problem, quite apart from concern in the matter from the social and personal aspects. There is a perennial fascination about the subject, which fascination becomes deeper when one is put to individual inconvenience and discomfort by a miasmic environment. There was fog in London last Thursday afternoon and evening, when Mr. C. E. Brackenbury, Barrister-at-Law, was reading an edifying paper before the Society of British Gas Industries, on "Some Legal Aspects of the Smoke Nuisance." With the author those present travelled through legal space from the year 1190 to the present time; but all enactment and all legal decision, and all the remedial contribution made by the use of gaseous and smokeless fuels, have not relieved us of the nuisance. Which shows us that we have outgrown the ameliorating effects of existing legal enactment, and that something additional is now wanted.

Industries have greatly expanded; and with the expansion the number and magnitude of factories. The population has grown greatly; and with it the number of domestic chimneys. The factory chimney is now fairly well under control—not more, perhaps, through legal checks than from the persuasive motive of economy. The domestic chimney, however, is expressly exempt from legal supervision. And as Sir George Livesey would have it some years ago, at one of the Smoke Conferences in London, and as many students of the subject will have it now, it is the domestic chimney that is the greater sinner in contributing to the uncomfortable and dirty atmospheric conditions particularly in the winter time. It is not what a single chimney emits that is a nuisance; it is the aggregate emission that causes the mischief. Then what is to be done?

On these matters, as Mr. Brackenbury points out, public inertia is such a ponderous thing that there is no stirring it without taking some drastic steps; and he is not sure that one way of effectively doing it would not be by the legislative imposition of a tax on every chimney used for carrying off visible smoke from houses above a certain annual rental. There is, however, an unpreparedness for any satisfactory campaign; and facts and figures on lines suggested by the author are the precursive *desiderata* to action. Educational work among the people and in the nation's schools in the matters of atmospheric sanitation and the use of smokeless fuels would, Mr. Brackenbury and some of the speakers in the discussion believe, do much to enlighten, foster antagonism to the existing evil, and create a desire for some less crude method than the burning of coal in open grates with all the accompanying contaminating influences. But above all is the question of cost, asserts the author; and the President of the Institution of Gas Engineers (Mr. J. W. Helps) says it is not the slightest good trying to represent that the gas-fire over a period's continuous use is, from the bare cost standpoint, as economical as a coal fire. That is quite true, with the qualification affixed that the gas-fire can be used intermittently as desired, whereas a coal fire once lit the consumption of fuel must continue if the trouble of relighting is to be avoided. The economy of the gas-fire rests largely in its availability for use, and in the ease of lighting, extinction, and relighting; and other recognized considerations have to be added. The gas-fire of to-day, too, is a vastly more economical thing than the gas-fire of the past. In lessening the great evil of atmospheric impurity, the gas industry—true, it may be selfishly—has done a considerable part. The hundreds of thousands of cooking-stoves and gas-fires in London alone cannot have displaced all the raw fuel that their use represents without having produced some relief. This work has been quietly going on under the old conditions of gas supply; and the industry is devoting itself assiduously to seeing how best to put itself in the position to sell more British thermal units than before for a given sum. Their success in this direction will be of substantial advantage in the campaign against atmospheric pollution. As an aside, it may be mentioned that Mr. D. Milne Watson, the General Manager of the Gaslight and Coke Company, tells us they have never been so busy fixing gas-fires as now. However, by educational work, and by the provision of cheap gaseous and solid smokeless fuel, perhaps greater good can be done than by invoking the aid of the law. It is no use ordering that people shall not do this or shall not do that if, from the point of view of cost, there is not something of superior merit at hand; and, what is more, the British public will not be driven.

The Explosion at the Geneva Gas-Works.

In another part of the "JOURNAL" will be found a few particulars in regard to the disastrous explosion which occurred at the Geneva Gas-Works on the 23rd of August, some of the effects of which have already been shown in our pages. The information furnished elsewhere does not throw any light upon the cause of this terrible accident, which is, we believe, still under investigation by competent experts. It has merely been obtained from a report presented to the Municipal Council some weeks ago. It shows, however, that, notwithstanding the great shock which all the responsible officials must have sustained—a shock almost paralyzing in its effects—steps were taken, on the very afternoon of the accident, to set the works in order and restore the supply of gas as soon as possible. When the extent of the damage, as revealed by our illustrations, is borne in mind, the fact that the works were stopped for only seventeen days is creditable to the Municipal Gas Engineer (M. Des Gouttes) and to those acting under him. A highly commendable action was the distribution of warning notices to the consumers, the exercise of whose prudence, as the result, probably averted troubles outside the works. Another feature worthy of being specially noticed is the spontaneity of the public sympathy displayed on the occasion, and its tangible expression in the subscription of £2700 for the assistance of the bereaved families. The fund is now being administered. The cost of the explosion is estimated at about £4300, half of which has already been paid by the companies in which some of the damaged plant and buildings were insured. This, however, does not represent the full extent of the liability of the Municipality, as claims in respect of external damage are under investigation. Altogether, the explosion was most deplorable; and it is to be hoped that when the report of the technical experts is issued, it will not convict anyone of culpable negligence in connection with it.

High-Pressure Gas in Birmingham.

In the course of an address (abstracted on another page of to-day's issue) which was delivered a few days ago by Mr. Sydney R. Barrett, the Superintendent of the Fittings Department of the Birmingham gas undertaking, to the members of the Master Gas-Fitters' Association, interesting information was given with regard to what is being done by the Corporation in the direction of providing a high-pressure gas supply. This was not, of course, the sole topic of the lecture, which had for one of its objects to impress upon the practical audience the adaptability of high-pressure gas to manifold manufacturing operations, as well as the best means of utilizing both high and low pressure supplies for the lighting of factories. It was pointed out that, in addition to the reduced charges for lighting, specially low rates are now charged in Birmingham for gas used for motive power; while within recent weeks a further concession has been made to manufacturers in the price for gas used for heating in various manufacturing processes. In regard to these matters, however, readers may be referred to the address itself. The portion to which it is chiefly desired to draw attention here is the Birmingham high-pressure service. Mr. Barrett told his hearers that, in order to eliminate the cost to the public of increasing gas pressure by private installations, the department are now erecting plant for supplying gas at high pressure—probably about 60 inches—throughout a large district. According to arrangements already sanctioned by the Corporation, the mains for high-pressure gas—or "reinforced" gas, as Mr. Barrett prefers to call it, regarding "high-pressure" as somewhat of a misnomer—will be run in the centre of the city; and it is hoped the supply will be available in the course of four or five months. The first mains to be laid will, however, form only a portion of a very much larger scheme; and it is hoped that further developments will speedily follow. From the manner in which the high-pressure supply where available in London is being taken advantage of, there would seem to be little doubt that the Birmingham Corporation will be amply rewarded for their enterprise in this direction, and that extensions of the system will very soon be called for. The citizens generally are to be congratulated upon the fact that they are served by so go-a-head a Gas Department. While referring to this subject, it may be noted as a somewhat curious coincidence that on the day following Mr. Barrett's lecture an article appeared in the "Birmingham Gazette" entitled "Electric Power in the Factory and the Workshop," one of the paragraphs of which is headed "Wonderful Transformers." This seemingly inspired article states that the motor connection through the town mains now equals over 17,000-horse power. Taken at the low cost of (say) ¾d. per horse power per hour (1d. would perhaps be nearer the actual cost) for nine hours per day during 300 working days, the receipts from this source (£143,437) would be considerably in excess of the total income of the department last year from current for both lighting and power (£114,200). Do their customers have motors fixed, and then find it too expensive to use them? This is a point with regard to which manufacturers will do well to thoroughly satisfy themselves before going in for electrical power installations. Extreme optimism is frequently a strongly marked characteristic of electrical articles and advertisements; and Birmingham appears to provide no exception to this.

A London Advertising Campaign.

In the "Electricity Supply Memoranda" last week, reference was made to an announcement that the metallic filament lamp has hit the London Electricity Supply Companies so severely that they have resolved upon a vigorous campaign to obtain additional custom. The campaign has begun and smartly, by a couple of pages of advertisements in the "Westminster Gazette"—the central parts of the pages being occupied by articles on "Heat and Light in the Home" and "The Romance of Electricity." But, as usual, electricity follows gas; for similar publicity for gas had previously appeared in the "Pall Mall Gazette," accompanied by bold advertisements by the Gaslight and Coke Company. For the electricity advertisements (some eleven of the London Companies are subscribers to the cost), we may say that they are very fairly framed; and there are in them none of the venomous attacks on gas that have previously characterized much of the electrical literature designed to capture fresh custom. But the electricity articles contain one or two diplomatic mistakes. John Bull was insulted. "He thinks," it is written, "in his delightful, muddle-headed way, that old friends are good enough for him;" and further on he is pictured pushing his hands into the "lowest depths of his capacious pockets, preparatory to a stretch of his clumsy limbs, and a sigh of content." John Bull is not the lethargic, muddle-headed individual that is here portrayed; for if we turn to one of the advertisements of the Gaslight and Coke Company in the "Pall Mall Gazette," we see that, in the district of that Company alone, 358,000 of the housewives of John Bull have gas cooking-stoves on hire, and in an article on "The Best Servant in the House," in another edition of the same newspaper, it is stated that "we have ascertained that considerably over 1000 gas-fires have been fixed during the past two years for members of the medical profession in London. Such testimony to their healthful qualities needs no labouring." This is only a small proportion of the gas-fires that have been connected up in the same period in London—the period of the 1d. per unit electricity for heating purposes. In another advertisement by the Gaslight and Coke Company, it is stated—and there is plenty of experience to support the assertion—that "heating by gas at 2s. 9d. per 1000 cubic feet is only one-fifth as costly as heating by electricity at 1d. per unit. That difference in cost" [all householders have not the capacious pockets represented in one of the electrical articles] "and the difficulty of obtaining adequate warmth from electric radiators, are causes that have led to the displacement of electricity by gas for heating in many instances." Lighting and many other matters, such as water heating, are dealt with in both the electrical and the gas articles. In the electricity articles, it is acknowledged that the metallic filaments of the new electric lamps "are brittle, and must be carefully handled. . . . When once placed in the holder, they should not be removed until their work is done. These considerations make it desirable that the metallic filament lamps should not be used promiscuously. They would be liable to break if employed in fittings designed to be raised and lowered, or where they would be kept in an upright or extended position."

A Campaign among Southern District Juniors.

The attention of juniors in the large number of gas-works which are situated sufficiently near the Metropolis to render possible an evening meeting in the City occasionally during the winter months, may be drawn to the remarks made at last Friday's gathering of the London and Southern District Junior Gas Association by the President, Mr. W. J. Liberty. The present session will be the second one under Mr. Liberty's chairmanship; and with characteristic energy he is entering on a recruiting campaign with the idea of largely swelling the membership roll by the time his renewed period of office draws to a close. The Association at present numbers some 140 members; and this the President expresses himself as desirous of bringing up to the good round figure of 200. To add a further 60 names during the session may not be easy; but there is no reason—considering the district from which they can be drawn—to believe that it is impossible. In fact, the indications would seem to point to the likelihood of the end in view being achieved through the "little campaign" which Mr. Liberty has announced his intention of entering upon. During the past few weeks about 20 new members have joined; and the list, which was read out on Friday, is such as to lend support to the contention that places outside London are taking a far greater interest in the Association than was formerly the case. It was pointed out at the meeting that there were two new members present who came from as far away as Reading; and if they think it worth while to come up to town for the meetings, others in similar positions might well be induced to take an equally long railway journey. London is, of course, a large place; and trains from the surrounding districts enter it from all sides. But the Cripplegate Institute, in Golden Lane, where the meetings are now held, is probably in as central a position as any place could be, having regard to the different locations of the various termini. Additional promise for the success of his campaign is held out to the President by the fact that many of the seniors have lately expressed to him the hope that their juniors would join the Association. Indeed, it is, as he says, really in view of this that he has made up his mind to try and bring so many new members into the fold. We shall hope to be able later on to record the complete success of his efforts. It is, of course, not to be expected—and Mr. Liberty does not expect—that new members will join with the sole object of assisting him to carry out his plan. They must be convinced that they will derive material benefit from doing so; and in this connection attention may be drawn to the uncompleted portion of the programme for the present session, which includes, besides papers and several visits to works, lectures from such well-known men in the profession as Mr. Jacques Abady and Dr. Harold G. Colman. It is open to all to remain at home and read reports of the proceedings in the pages of the "JOURNAL," without lending their active support to the movement; but if everyone elected to do this, where would the "proceedings" come from? With an augmented membership—and particularly if it be drawn from a wider district—the power of the Association for doing good work will be increased; and thus, excellent as the present one is, future programmes may be rendered still more attractive. The Hon. Secretary of the Association, it may be mentioned, is Mr. S. A. Carpenter, of No. 25, Briarfield Avenue, Finchley, N.

The Reduced Welsh Coal Output.

Figures which have been published within the last day or two with reference to the output of coal in South Wales are fully sufficient to explain—if the explanation were now needed—the intense unpopularity locally of the Mines Eight Hours Act. The measure has been in operation long enough to permit of some sort of comparison being made; and the showing is a disastrous one. Something may, no doubt, be put down to the trade depression; but it must be pointed out that right up to May, outputs and exports were greater than in the corresponding month of last year; so that the subsequent heavy falling off could not possibly have been even mainly due to the existing trade conditions. On July 1 the Act came into operation; and the period that has since elapsed has witnessed a staggering change in the position of affairs. Taking Cardiff as being the chief centre, it is stated that during the first six months of the year the coal exports showed an increase of no less than 593,000 tons, as compared with the corresponding half of 1908; but during the past four months there has been a decrease of 314,000 tons on the same period of 1908. From July to October, the falling off in exports in the case of the four principal Bristol Channel ports amounts to 761,800 tons, or a loss of no less than 6½ per cent. when compared with the same period of last year—and this in place of the satisfactory rate of increase which was experienced in the first half of this year. In spite of the much smaller business, it appears from the "Labour Gazette" that the average monthly number of persons employed at the collieries supplying returns to the Government was, during August, September, and October, 144,033, as compared with 143,171 in the same period of last year. These are the considerations which affect respectively the colliery owners and the workers. From the point of view of the third party—the consumer—the price is the most important factor; and in this connection it is stated that, as compared with the first quarter of the year, the price during the third quarter for best Admiralty steam coal showed a rise of 3s. a ton.

Compulsory Uneconomic Venture.

The procedure—obligatory or otherwise—of Government Departments is not always in the best interests of communities. Instances are afforded by Widnes and Macclesfield, and several other towns might be mentioned. As a matter of principle, it is

not, of course, the correct thing that electricity supply powers should be obtained through Provisional Orders by local authorities, for the express purpose of acting as a barrier to others exploiting the district; but, as a matter of practical politics, there may be something to be said in defence. When such powers are obtained by a local authority through Provisional Order, if they are unexercised at the end of the defined period, the Board of Trade have the power to extinguish them. Under such circumstances, local authorities, being usually distinctly antagonistic to private enterprise usurping what they regard as their own rights, would rather, on the pressure of a threat of annulment being communicated by the Board of Trade, enter into a scheme, notwithstanding that it may be to the financial disadvantage of the community. Take Widnes as a striking example. There gas is supplied by the Corporation at a price lower than rules elsewhere in the world; but having an unexercised Electric Lighting Order, the Corporation are now compelled to do something to justify the retention of the powers, or have Widnes for electricity supply purposes thrown open to others—not that it would be a great catch for the others with gas at the present price. What is the effect of this forced move on the part of the Council? They are compelled to spend money on a scheme; and the loan will require sinking fund and interest. With such cheap gas in the area, this capital expenditure will not have much scope for lucrative employment; while, on the other hand, it is impossible to introduce any new form of competition without affecting established interests. With a competitor taking away part of its business—existing and possible—so much greater the difficulty of the gas undertaking in continuing to pursue, with the same vigour, past policy. Both undertakings are placed at a disadvantage, and so through them are the people of the whole district. Looking at the matter from the standpoint of economic expediency, it does not seem to us that this compulsory introduction of a competitor is in the best interests of the community.

American Commercial Gas Association.

The fourth annual meeting of this Association will be held in New York from the 14th to the 21st prox.; and in connection with it an exhibition of gas appliances will be held in Madison Square Garden. A feature of the meeting will be illustrated lectures on subjects of interest to those who are specially concerned with the practical development of public and private illumination, by Mr. H. Thurston Owens and Mr. Van Rensselaer Lansingh. The following papers have been promised:

"The Best Policy to Follow in Increasing Sales in Towns where both Gas and Electric Companies are under One Management," by Mr. C. N. Stannard.
"How to Increase Sales of Gas to Existing Consumers," by Mr. G. R. Chamberlain.
"Promoting Sales of Gas in a Small Town," by Mr. A. V. Wainwright.
"Future of Gas for Street Lighting," by Mr. E. U. Wrightington.
"Future of Gas for Store Lighting," by Mr. R. B. Young.
"The Development of the Use of Gas for Industrial Purposes, Present and Future," by Mr. S. T. Watson.
"The Application of Architectural Designs to Gas-Fixtures," by Mr. L. F. Blyler.
"Advertising," by Mr. T. R. Elcock.
"Theory of Combustion," by Mr. T. O. Horton.
"Sale and Maintenance of Gas-Engines," by Mr. E. C. Duerr.
"Gas-Engines in Competition with Central Station Electric and Isolated Steam Plants," by Mr. W. W. Cummings.
"General Maintenance and Special Troubles," by Mr. R. H. Thomas.
"Water Heaters," by Mr. G. W. Savage.
"The Necessity of Maintaining Pleasant Relations between the Manufacturer and Gas Company," by Mr. George D. Roper.

On the evening of the 17th, there will be a joint meeting of the Association and the Illuminating Engineering Society. The exhibition, which it is stated will be on a scale of considerable magnitude, will be open day and evening during the six days of the meeting.

Proceedings of the North British Association.—We have received the report of proceedings at the forth-eighth annual meeting of the North British Association of Gas Managers, held at Stirling on the 29th and 30th of July, under the presidency of Mr. J. D. Smith, the Engineer and Manager of the Stirling Gas Company. The technical matter, which is illustrated by plates, is followed by lists of the officers and members, the rules and regulations of the Association, and the "Statistical Report" of the gas supply of Scotland in the year ended May 15, 1909, published by the Committee of the Association. A photograph of the excursion party at Callander, on the second day of the meeting, forms the frontispiece; and there is a portrait of the President. The book has been produced under the supervision of Mr. Lawrence Hislop, of Uddingston, the Secretary and Treasurer of the Association.

GAS STOCK AND SHARE MARKET.

(For Stock and Share List, see p. 637.)

THINGS on the Stock Exchange last week moved very irregularly. Markets were sensitive and uncertain—a prey to some degree of apprehension. Next they would brighten up a bit, only to be again cast down; and so the pendulum swung backwards and forwards almost from day to day. This was especially the feature in the more speculative lines, which at times were very flat. The opening on Monday betrayed weakness that spread and lowered the general tone. The gilt-edged class were uneven, and Rails weakened; while Americans, South Africans, and the Mining Market were depressed. On Tuesday, movements were quite irregular (some up and some down); and the choicest lines were weaker. However, Wednesday brought about some degree of recovery; the settlement (it was account week) not presenting any terrors. Business fell very quiet on Thursday. The political embroglio was the most disquieting factor; but Home Government issues were firm. The Foreign Market was good also. Things remained quiet on Friday; but the general tone was fair. Buying for investment was apparent and Consols still crept up. Most markets were stronger; and the announcement of a small failure was little noticed. On Saturday, the general features were much the same. Consols rose another $\frac{1}{16}$. In the Money Market, there was an excellent demand for Stock Exchange and other purposes, and rates stiffened; but before the close the tension was relaxing. Business in the Gas Market was not at its best. Fewer issues than usual were dealt in; and these were less active, with a dull tendency for the most part. In Gaslight and Coke, the ordinary changed hands at the same figures as the week before, but the quotation was drawn in closer. The secured issues did not vary, the maximum realizing $87\frac{1}{2}$, the preference from 104 free to 105, and the debenture $82\frac{1}{2}$ and $83\frac{1}{4}$. South Metropolitan had more transactions than lately, but at lower prices. The range was from $119\frac{1}{2}$ to 121—a fall of 1. The debenture was done at 82—a fall of 1 also. In Commercials, the 4 per cent. marked $109\frac{1}{2}$ and $110\frac{1}{2}$, and the $3\frac{1}{2}$ per cent. $105\frac{1}{2}$. Among the Suburban and Provincial group, Alliance and Dublin new was done at $12\frac{3}{4}$. The debenture was put up 2—a move which followed sharply upon the purchase of a good parcel of the same stock at a much lower price at the Mart. Brighton original was marked at $210\frac{1}{2}$, British rose $\frac{1}{2}$, and nothing else was touched. In the Continental companies, Imperial was weaker, at from 178 to 175 (a fall of 1); and the debenture fell a point, also without business marked. Union realized 98 and $98\frac{1}{4}$, ditto preference 138, and European fully-paid $24\frac{1}{2}$. Among the undertakings of the remoter world, Buenos Ayres changed hands at $13\frac{9}{16}$ and $13\frac{3}{4}$, Monte Video at $12\frac{7}{8}$, Primitiva at 7 (a fall of $\frac{1}{8}$), ditto preference at $5\frac{1}{4}$ and $5\frac{5}{16}$ (a fall of $\frac{1}{4}$), ditto debenture at 96, River Plate at $16\frac{1}{4}$ and $16\frac{9}{16}$, ditto debenture at $97\frac{1}{4}$ and $97\frac{7}{8}$ (a rise of 1), and San Paulo at $14\frac{9}{16}$.

ELECTRICITY SUPPLY MEMORANDA.

A Lukewarm Reception—Failures and Effects—Active Commercial Work—Itinerant Vendors and a Question of Profit—Technical (!) Knowledge.

A LUKEWARM reception has been accorded the presidential address of Dr. Gisbert Kapp to the Institution of Electrical Engineers. The usual laudatory things were, as a matter of form, said in the speeches accompanying the vote of thanks; but behind these, the question has been asked whether Dr. Kapp has risen to the occasion offered him, and whether by a careful microscopic examination of the address anything can be found that his hearers did not know before. We will not traverse the address. It was devoted mainly to electrical engineering; but there was nothing much that had to do with the commercial side of electric supply. The immense growth of the capital of the industry during the past decade was referred to; but the lamentations as to the want of prosperity of the industry show clearly that the whole of the capital has not been usefully employed. In ten years the capital of the electricity supply companies has gone up from £9,265,793 to £45,743,744, and that of electricity supplying municipalities from £8,531,167 to £51,796,604, while the electric manufacturing capital has risen from £16,799,152 to £42,486,269. Dr. Kapp refers to this expended capital as wealth. Wealth always carries with it the idea of prosperity; but a large part of the "wealth" of the electrical industry is anything but flourishingly productive. How comes it, the President asks, that the electrical engineering industry is not nearly as prosperous as it might be? He cannot give a very decisive answer. Of this, however, he is convinced—that British shops can turn out work equally as well as Continental ones, and generally at a slightly lower prime cost. There is certainly, he says, no justification in reproaching the makers of electrical plant with backwardness; and, moreover, it is bad business policy. If, however, the reproach is levelled against the potential users of such plant, there is some justification, and also a reason. Our great staple industries are old-established, and have been fairly prosperous for generations; those on the Continent are of recent growth, and have had to struggle into existence against English competition. To become successful, they had to adopt every improvement which

science put at their disposal. With them the application of electricity is, Dr. Kapp says, almost a vital matter; with us it is only a desirable improvement. To accelerate progress, the potential users of electrical plant must be educated. A beginning in this direction has already been made by the managers of electric light stations. And so he goes on, winding up with an exhortation to the Institution to also do something to accelerate the introduction of electricity into the great industries. He soars high above domestic electrification; but his method of doing so has not the originality about it that attracts and gives pleasure.

By an inexplicable perversity of fate, just when electricity supply should be putting on its best behaviour, so as to aid the vendors of electric current to swell their business connections to balance the loss of output by the extended use of metallic filament lamps, there has been quite a crop of failures of electricity supply in various parts of the country. Some were noticed last week. Woolwich has been in trouble to an uncomfortable degree. About a fortnight ago there was a partial collapse due, so it is alleged, to a cable being punctured by a workman's pick. The injury, so it is also reported, was quickly remedied. Workmen's picks may have much to answer for; but they are appearing rather too frequently now among the minor excuses for electrical failures. It would be advisable not to cause a rapid exhaustion of patience by laying the blame too constantly upon wayward pick penetrations. But it was not a pick that caused Woolwich to suffer yet another electrical extinction on Monday night last week. This time it was confessedly a genuine breakdown at the electricity works; and such consumers and public places as were not supplied with gas descended into darkness about 7.30. Street-lamps were extinguished; many business establishments had to be closed; at the Hippodrome the performance had to be abandoned; and town councillors sitting in semi-darkness at the Town Hall were impressed by the unfaithfulness of their own electrical possession. Failures of the kind are not incidents of which one can make sport; their gravity lies in the loss, inconvenience, and danger that they occasion. Some of the streets of Woolwich were in darkness, offering vice and violence an open field. Why? Because gas had been evicted to give place to the costly and fickle rival. Business premises had to be closed where electricity was in use; and in many instances no doubt profitable custom was lost. Why? Because gas lighting was not there. The Hippodrome had to be closed. Such closure and loss of business would have been prevented, and the public safety assured, by the simple expedient of having gas in the place. Do the London County Council's regulations as to theatres apply to hippodromes? If not, why not? If they do, why was the Woolwich Hippodrome put out of action? The public safety in such places must come before the mere saving of a trifle in keeping a dual installation for artificial illumination in good working order. We notice in another suburban area that a tradesman who has suffered from collapses during the business hours of the evening has compromised matters by having his premises outside fitted with high-power incandescent gas lamps in place of metallic filaments—retaining the latter form of lamp inside the windows. In this way he has halved his patronage, but secured protection for both business and goods. The memory of failures that affect business has a lingering tendency.

Show-rooms here, showrooms there, and show-rooms everywhere. What with providing show-rooms and getting-up exhibitions which the (almost) dividendless electrical manufacturers have sometimes to stock, the electricity supply industry is busy. The time for waiting for electricity business has passed; and a greater activity must needs prevail. In some instances the show places are fitted-up with rooms tastefully furnished, so as to exactly represent how for electric lighting they should be fitted and what is the effect. Then there are those pretty little things for human convenience like shaving-pots and curling-irons to be exhibited; together with the advances of application along the expensive electrical way in the shape of radiators and various cooking apparatus of minor degree in performance and economy. There has been opened in the South Metropolitan Electric Supply Company's district an additional house, demonstrating domestic electrification. Members of the Press were invited to go down and inspect it last Thursday. We were not of the number. One of the attractions for the Press men was the promise of electrically cooked food. We have not, up to the time of writing, met with any one of the journalists who went down to see and (possibly) to eat. We feel regret, which is deeply shadowed as we remember the words of Mr. R. Borlaise Matthews (*ante* p. 382): "The cooks complain that the fruit in a pie boils, while the pastry becomes heavy." Another development of the show-room business is credited by one of our electrical contemporaries to the Westminster Electric Supply Corporation. Most districts have shops to let in these times when electrical failures are not, unfortunately, the only ones to be recorded. The Electric Corporation make a choice of these places, and rent them for a period (say) of fourteen days, so that exhibiting is carried on successively in the various districts. The wrinkle is an excellent one. However, it is good to see all this activity. But there seems some idea in the electrical mind that we are opposed to electricity suppliers doing their best to advertise domestic electrification, while advocating the opposite regarding gas supply. Some people suffer from contracted vision. Our only objection to domestic electrification effort is when it is shrouded in untruth. We do not claim that our robes are of immaculate whiteness; but by no deliberate act are they soiled.

In a lecture at the London Institution last week, to which reference is made elsewhere, Mr. Leon Gaster called attention to the knavish tricks that mar the electric incandescent lamp trade, whereby consumers have palmed off on them lamps that are not what they are represented to be, and which lamps assist such inconveniences as failures of current, and sudden collapses of lamps, and expense to bring electric lighting into disrepute. Consumers, of course, are to be blamed for not dealing with tradesmen of good standing, who are in a position to advise them as to the best forms of lamps to employ. At the same time the instinct of the human race is more largely directed to economy than to extravagance in the means of artificial illumination; and this works in more ways than one to the advantage of gas lighting. The only thing that can be done to put a stop to the vicious practices of the unscrupulous dealers in such lamps is for the electricity supply undertakings to issue warnings against itinerant vendors and other traders whose wares are notoriously both cheap and nasty. The same might be done in connection with incandescent gas burners and mantles. The "throw-outs" of which Mr. Gaster speaks in alluding to incandescent electric-lamps are the "seconds" of the mantle industry, and besides them—the deformed and the otherwise defective—there are mantles of very inferior quality. We have seen examples of these that have been purchased at the door from men whom the householder may never set eyes on again; and many of these wares are the enemies of the gas industry. The itinerant class of business has extended largely to the electrical industry; and the men who engage in it are the embodiments of commercial irresponsibility and licence. They have none of the conventional drawbacks of the ordinary tradesman who is tied to his shop with all its expenses. They can sell what they please, and are satisfied if a shadow of profit crosses their palms. This condition of things, says an electrical contemporary, is rough on the genuine retailer of lamps. "He cannot possibly, even if he were willing to do so, sell high voltage tungsten lamps of any make for 3s., yet such lamps are being hawked about freely at this figure. Anyone who has bought these lamps will require a lot of persuasion to spend 4s. or 4s. 3d. apiece for the next batch he requires, and he may refuse to pay more." This statement is interesting. It indicates that respectable high-voltage lamps are being sold at 3s., at the householder's door; and the man who so sells would not walk and trade if he were not making something for himself. It also shows that rather more than a shilling and fifteenpence are the lines of profit-making the tradesman looks for in such lamps. With such a profit hanging to the lamps, there is ready understanding of the tradesman's chagrin over the action of his wandering competitor, and also of the electrical contractors' desire to do all in their power to prevent the local electricity undertakings entering into the fittings and lamp business, and so preserve the profits for themselves. Electric lighting consumers seem to be the victims of imposture from electricity supply to lamps. They are compelled to furnish the greater part of the profits of an electricity undertaking, contribute towards the capital expenses incurred in the supply of the power consumer, and, on every lamp they buy, they hand over a percentage of profit that would not have found credence with us had it not been stated in—dare we say it?—an electrical paper.

Some of our electrical contemporaries have been drawn into comment upon Mr. H. N. Clark's recent Southern Association paper; but, in doing so, they carefully avoid his evidence as to gas having displaced electricity for lighting in certain premises at West Ham, and as to the actual cost figures for running a high-pressure gas installation. On the point as to an electric stand-by for driving the compressing plant, the "Electrical Review" makes the following enlightened remarks: "One speaker was surprised that an electric stand-by should be suggested, and he pointed out that the high-pressure installation in Fleet Street was worked without the aid of electricity. Four engines are used, as it appears, *one at a time*. The stand-by, therefore, is three times the size of the running plant. Comment is needless." The speaker was Mr. W. J. Liberty; and the "JOURNAL" report of his speech states in reference to the high-pressure lighting in Fleet Street and the neighbourhood: "They had duplicate plant with four engines in all—*two in each section*; and it was only a question of turning a handle to get the other section into running." Commment on our contemporary's statement, we agree (and are indeed pleased to be in harmony on this occasion) "is needless."

A Long Concrete Pipe Conduit.—A 12-mile conduit of 36-inch concrete pipe has been built down the canyon of the Middle Boulder Creek on the east slope of the Rocky Mountains in North-Eastern Colorado, as part of the hydro-electric development of the Eastern Colorado Power Company on that stream. A high cyclopean-concrete masonry dam across the stream at Barker Meadows, 17 miles west of Boulder, and at an elevation of 8000 feet above the sea, will form a large reservoir for impounding water. According to some particulars in "Engineering Record," the 36-inch concrete pipe-line extends from the dam down one side of the canyon to a power station which is under construction four miles straight west of Boulder. The conduit is on a hydraulic grade line, having a fall of approximately 26 feet to the mile, while the creek drops very rapidly between the dam and the power-house. As a result, the pipe-line is at an increasing height above the stream; the difference in elevation between its lower end and the power-house being nearly 2000 feet.

PERSONAL.

OFFICIAL CHANGES IN THE SUNDERLAND GAS COMPANY.

THE lamented death of Mr. J. H. Cox, who for upwards of sixty years was Secretary and Manager of the Sunderland Gas Company, rendered necessary a rearrangement of the Company's staff; and at a meeting of the Directors held last Wednesday, Mr. Charles Dru Drury was appointed Engineer, with charge of the manufacturing operations at the Company's two works at Hendon and Ayres Quay, and Mr. Norman S. Cox was appointed Secretary, with charge of the distributing department; each official being directly responsible to the Directors for the management and control of the work entrusted to him. In addition, Mr. A. H. Bagshaw and Mr. H. H. Collett, members of the Company's staff, are appointed Works Managers at the Hendon and Ayres Quay Works respectively under Mr. Drury.

In connection with these appointments, it may be interesting to mention that Mr. Drury was educated at Ramsgate and at the Cheltenham College, studied for several years under Professor Henry Adams at the City of London College, and holds numerous certificates from the City and Guilds of London Institute. In 1880 he was a pupil of Mr. P. J. Wates, who at that time was Engineer of the Vauxhall works of the South Metropolitan Gas Company. Five years later he was appointed Assistant to Mr. Charles Carpenter, who succeeded Mr. Wates. In 1892 he obtained the position of Manager of the Hendon works of the Sunderland Gas Company. During his residence there they have been largely extended and modernized; and, under his supervision and direction, installations of both West's and De Brouwer stoking machinery have been introduced into two of the retort-houses, with very satisfactory results. These works have now a total productive capacity of 6 million cubic feet gas per day, though the actual maximum make so far has been 5 millions. In addition, as our readers are aware, Mr. Drury has been engaged for the past two years and a half in designing and carrying out the entire reconstruction of the Company's Ayres Quay works, which when completed will have a maximum productive capacity of 1½ million cubic feet per day. This work includes the first installation of Dessau vertical retorts in this country, the bench consisting of six beds of ten retorts each; and, if successful, it will probably be doubled in due course. It is expected that these works, which were described and illustrated in the "JOURNAL" for the 6th of July last (pp. 22, 25), will be brought into operation in the course of a few days. Mr. Drury, it may be remembered, was President of the North of England Gas Managers' Association in 1898-9. Mr. Norman Cox was educated at Repton School, and in 1894 was Mr. Drury's pupil at Hendon. He was appointed Assistant there in 1901; and two years later became Assistant Secretary and Manager of the Company under his father.

Mr. GEORGE W. HURST has resigned his position as Manager of the Shepshed Urban District Council Gas-Works.

Mr. GAVIN MUIR, Manager of the Stonehouse Gas Company, Limited, has been appointed Manager of the Neilston Gas Company; and Mr. JOHN BROWN, Assistant at Stonehouse, has been promoted to the position vacated by Mr. Muir.

OBITUARY.

Mr. T. C. SKARRATT, of Kington, who died last Wednesday, at the advanced age of 91, was for many years Chairman of the Kington Gas Company.

The death occurred, on the morning of the 20th inst., of Mr. WILLIAM SCARRATT, of Basford Park, who had been for forty years in the service of the British Gaslight Company, Limited, at their Potteries station. The deceased was widely and favourably known and highly respected; and his funeral, which took place last Tuesday, was largely attended—among the mourners being Mr. J. R. Heath, the Manager of the Hanley Gas-Works, and other officials of the Company.

The death occurred on the 8th inst., in his 81st year, after a long and painful illness, of Mr. ROBERT FIELD, who was Manager of the Bishop Auckland Gas-Works from 1865 to 1904. Prior to his appointment at Bishop Auckland, he was in the service of the Hartlepool Gas and Water Company. He was for many years a member of the North of England Gas Managers' Association. Deceased was a highly respected and trustworthy servant of the Company. At his interment at South Church, Bishop Auckland, every mark of respect was shown by Directors of the Company, fellow gas managers, the workpeople, and the general public.

Masonic.—Last Wednesday a new Masonic Lodge was consecrated in the Province of Derbyshire—the Hope Valley Lodge, No. 3397. Among the founders were the Chairman (Mr. Ambrose Frith) and Manager (Mr. T. H. Brown) of the Hathersage and District Gas Company, Limited. Mr. Brown—son of Mr. Thomas Brown, a member of the Northern Star Lodge—was appointed I.G. of the new lodge.

THE STRIKE OF GAS WORKERS IN ITALY.

No Agreement, but a Collapse.

WHEN writing last week, there were all the welcome signs of a speedy and effective ending of the strike of men employed at the works of the Union des Gaz at Milan, Genoa, Alessandria, and Modena. It will be remembered that conditions were arranged with the Prefect, the Company's Managers, and representatives of the men; and these had to be referred to the men. It was hoped that good sense would prevail; and that the men would accept them. But the contrary was the case—the conditions were declined. Further negotiations took place; and last Wednesday morning, as the result of a consultation between the General Manager at Milan of the Union des Gaz (Signor Grüss), the Prefect, the Syndic, and the delegates of the men, conditions were arrived at which the Government thought the men should accept. As the men would not signify approval, a ballot was taken on Thursday—opening at nine o'clock in the morning and continuing till five. The result was that 600 voted for continuing the strike, and 300 against doing so. Between 700 and 800 of the men did not record their vote. The ballot was carried on under very boisterous conditions; sticks and other missiles being freely used. On the result of the ballot being announced, Signor Grüss issued a notice that, unless the men presented themselves for re-engagement under the new conditions by four o'clock on Friday afternoon, they must consider themselves as dismissed; and the Company would take steps immediately to engage men to permanently replace them. The men were not long in appreciating for themselves personally the effect of the Company's ultimatum; and by midday on Friday they were returning to work in great numbers, and signing the new conditions under which they will be engaged. At Genoa the men resumed work on the Company's new conditions; and the same may be said of Alessandria and Modena.

KICKING OVER THE TRACES—INCENDIARISM.

Though, under the circumstances, there was every promise of work being peacefully resumed on the old men returning, hope was doomed to disappointment at the St. Celso station at Milan. There the men who wheel the coke from the retort-houses (the men who have occasioned more trouble than any other section of the workers), as soon as they were in the place again, refused to work unless they could have the old conditions—that is to say, maintaining the old organico, instead of the new. Carbonization, of course, had to be suspended; the stokers having to cease work on account of the coke men. Owing to this the production of gas was considerably limited; and the Manager was forced to once more curtail the supply to the town, and to leave the street-lamps unlighted. On Sunday questions also arose with other shifts; and the Manager was compelled to exercise authority and discharge fifteen of the coke men and fifteen apprentices, who declined to work for having been fined for being late. Subsequently the other squads consented, after a little discussion, to work; and it was hoped that matters would be completely readjusted by last night. To instance the absolute depravity of these men, they on Saturday and Sunday set fire to two of the large sheds that had been used for barracks. On Sunday, too, a fire was discovered near to a gasholder and benzol tank; and it was found that a fire-hydrant in the vicinity was plugged. This shows the intention of the cowardly and vindictive fellows. Articles in the latest Milan papers to hand are distinctly opposed to the men and their actions; and it is now clear that Signor Grüss was quite justified in asking, as a condition of settlement, that some fifty of these coke men should be discharged. He did not wish to have them back again, seeing that they were at the very bottom of all the trouble. It is now seen that the Manager was absolutely right; and had not cast any unjust reflections on the men.

The foregoing intelligence is gathered from the telegraphic communications received yesterday by Mr. W. Martin, at the London Offices of the Company. From Genoa, he heard that everything was going on well. There were no difficulties there; the men having gone back, accepting the conditions without reserve. Mr. Morton, the Engineer and Manager, has thus obtained, with very slight variations, what he, from the very beginning, insisted upon having. Everything, too, was reported as proceeding quietly at Alessandria and Modena.

The English contingent of gas workers who went out to render assistance arrived in London last evening.

THE OLD MEN AT WORK.

A Milan correspondent, writing before the foregoing telegraphic information was received, says:

Men voted by ballot on the 25th regarding the continuance of the strike. Over 600 voted for its continuance, and 300 odd for retaking service under the Company's conditions, while some 700 abstained from voting. On Friday, therefore, notices were posted dismissing the workmen who did not sign on before four p.m. under the terms of the new "organico," including the disciplinary clauses. This had the effect of entirely demoralizing the strikers' combination; and men commenced signing on before midday—in fact, some 1300 men personally signed their names at the various works and main offices as being desirous of commencing under the conditions imposed by the Company. These

conditions are that the scales of pay shall be the same as before the strike, including the graduatorio by which the men receive an automatic increase according to their term of service, as provided in the original organico; but the Company will be entirely masters in their own house, and the men will be obliged to give notice before leaving their work, &c. The question of reducing the number of men engaged on certain classes of work will be decided later; the Company stipulating that certain sections shall be reduced in accordance with the arbitration agreed to by the men in 1907. The arbitration decisions (which the men subsequently refused to acknowledge, and demanded in their recent famous memorial should be abolished, because they understood the ultimate decisions were not in their favour) remain unchanged.

The workmen on distribution service—including the main and service laying, street-lamp maintenance men, lamplighters, collectors, &c.—numbering about 300 men, commenced work on Saturday morning, and the works' staff were to commence on Sunday morning. The last charges were made by the English, German, and temporary Italian workmen late on Saturday; and they were (it is understood) removed during the midnight hours by special conveyances and special trains. The Company's old employees commenced service at 6 a.m. Sunday. All the works are in thoroughly good order, the machinery perfectly clean, &c., presenting a model to the men who have yet to learn what cleanliness and discipline really are. Mr. Hovey remained on duty constantly all Saturday night; and there were a number of military to ensure tranquillity. The strike has lasted some 25 days; and naturally enormous local interest has been taken in it.

Local manufacturers, and probably many others, are much gratified at the Company's success; and it is generally expected that the conditions of labour in Italy will be greatly modified as the result of this strike and the Company's strenuous fight. Certainly the men could scarcely have presented a more sorry spectacle before the eyes of the public and even of other workmen; for all knew that the Company had treated them much too generously in view of their indolence, their slovenly demeanour, and their insubordination.

During the strike excellent service has been rendered by Englishmen, Germans, and even Italians. Among the latter have been found some excellent men who actually seem to work for the love of it. The Company have a great number of applications for work from men in various stations of life; and it would be easy to construct an entirely new staff from these volunteers. The foreign assistant engineers have also done good service.

The Inciting Demagogues and Leaders.

A document called the "Order of the Day of the Strikers" has been received. According to the organ of the men, the leaders of the strikers in Genoa met at the Chamber of Work, and approved unanimously of this so-called "Order." It shows how the leaders exercise themselves with all the subtlety of their kind to excite their followers, and how unscrupulous are their methods and statements. The order is worth preserving; so here it is:

The General Council of the Chamber of Work of Genoa and Sampierdarena having met in order to consider the position created by the strike of the gas workers,

Having read the report of the Executive Committee of the Chamber and that of the gas workers,

Considering that the Union des Gaz in refusing to take back their staff on the former conditions (after the men gave up the claims contained in the memorial) act with criminal premeditation with the view of getting rid of a part of the men, and to crush their class organization, in order to be able to impose heavier conditions of work, and to humiliate the men with ferocious disciplinary conditions,

They applaud the dignified behaviour of the strikers, approving and encouraging their decision to continue in the resistance till they obtain the legitimate satisfaction to which they are entitled,

And reserving to adopt such other measures as may in future appear necessary for defending and supporting the strikers fighting against a foreign capitalistic company trying to oppress their men, also because they are Italians, and they consider them nothing more than persons from whom the most is to be obtained and the least given,

They decide—

(1) To approve the urgent decision taken by the Executive Committee in reference to the publication of a Manifesto to the townspeople, and in reference to the subscription inviting once more all sections of the Chamber and all the members to pay in the first special contributions from their funds, and the amount of half-day wages respectively.

(2) To give to the Executive Committee the mandate to promote, as soon as possible and contemporarily, some great public meeting in Genoa and Sampierdarena, to inform the townspeople of the present dispute, informing them of the enormous profit made in Italy by the Franco-English Company, and keeping alive the agitation against the strikers.

(3) To invite the Communes of the Ligurie to municipalize the important public service of the lighting, with advantage to the workmen, to the consumers, and to the communes.

(4) To protest against the abuses of the police against all the strikers, and against the maintenance of soldiers inside the works.

(5) To appeal to all the consumers sympathizing with the cause of the strikers, asking them to refuse paying the amount due for gas consumed till the Company has taken back in the works the old staff with a guarantee that the agreement, the decisions of arbitrators, and the existing uses will in future be respected.

By the conversion of the words "Chamber of Labour" by "Union des Gaz," an "order of the day" in very similar terms might have been issued by the Gas Company.

From the "Corriere di Genova" we extract the following:—

A Shameful Demonstration Against the Manager of the Union des Gaz.

Yesterday afternoon, we had at Genoa a proof of the new kind of education which the poor class receive at the hands of the pedagogues of Vico Casana Street.

The peaceful people who at six p.m. were hurrying home to dinner had to witness a demonstration reminding one of the beginning of the disturbances at Genoa in September, 1904, and at Milan in 1908. A crowd of hooligans, from 7 to 15 years old, accompanied by a number of women, marched from Via Lomellini, where the offices of the Union des Gaz are situate, to Piazza Deferrari, giving way to all the privileges of the uneducated and ignorant class, screaming and hissing the Union des Gaz first and the Municipality after.

And this is not all. At a stage of their glorious march, they saw in the street Mr. Morton, the Manager of the Gas-Works; and at once they surrounded him, and chased him the whole length of Via Carlo Felice, hissing and swearing, as far as the Hotel de Gênes, which the pursued man entered, withdrawing in that way from the deplorable chase.

And this is the most edifying part: The marchers were enclosed by policemen and "carabiniers," who proceeded carelessly, and almost smiling, as if it were the most natural thing; and no one knows how long the shame would have lasted undisturbed, if Mr. Morton had not had the good sense to enter the hotel.

These young heroes are certainly the same who at night crowd the gallery of the Apollo Theatre, enjoying the licentious performances which are served to them with the indulgent approval of the Authorities, who, being only anxious that the public order should not be disturbed, do not trouble about property being respected or the law of hospitality, and allow the mob to indulge in excess which may lead one to think that Genoa is an uncivilized town.

CHANDLER'S LATEST WASHER-SCRUBBER.

Patent "Spray" Washer-Scrubber.

The spraying of liquor on to surfaces as they revolve, so that the gas has a wetted substance to rub against, and the spraying of it simply into space through which the gas passes—depending alone upon centrifugal means for the efficient extraction of ammonia—are, of course, totally different systems of "spraying" liquor. Both applications have the same object in view; and while much may at times be expected with regard to many matters from information acquired from laboratory tests or even from results of actual working upon a very small scale, yet when large volumes of gas (running into millions per diem, or into figures such as those quoted below have to be dealt with), much speculation may arise in the minds of engineers as to the satisfactory accomplishment of purifying the gas by means of sprayed liquor alone. It may be found in the latter case that the gas and liquor part company far too rapidly, too easily, and very much too soon for the accomplishment of the desired aim. Although some four years have elapsed since the introduction of the vertical arrangement, up to now little has come before us of what has been done.

In the "Journal" for Jan. 19 last, in an "Editorial" under the heading "Purifying by Means of Ammonia," we made some reference to a document furnished by Mr. Samuel Chandler and perused by us regarding the above invention. The specification and drawings of the patent now completed, and which we publish below to-day, will give more complete information to readers. It was stated in the "Journal" referred to that, while there were reasons at the time for withholding fuller details of the subject regarding Mr. Chandler's latest ideas on washing and scrubbing gas, as disclosed by the document then before us, a notable advance appeared to have been made and that the inventor had again struck novel ground so far as the rotary washer-scrubber was concerned. There were also good reasons for believing that by the adoption of his improvement, washing and scrubbing apparatus designed for a capacity of 3 million cubic feet of gas per day would be equally efficient for 5 millions; and a perusal of the specification seems to establish our opinion as then expressed.

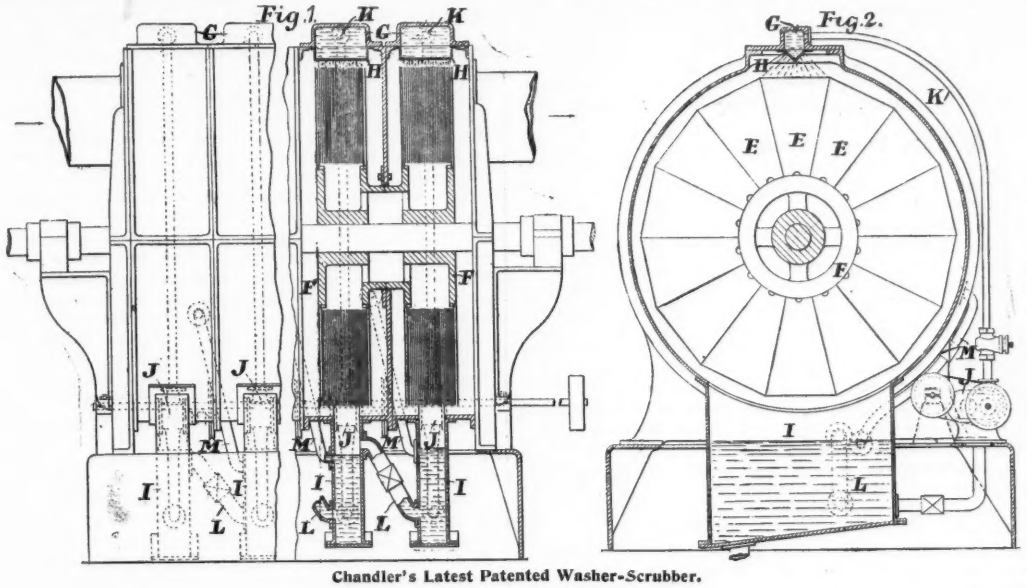
This being so, it should be admitted as a very great stride in the development of rotary washer-scrubbers, especially as such an important advantage as this by no means stands alone. It is noticed in the provisional specification that an example is given as to how this large additional work is accomplished—viz., "if a machine contains a total wetted washing and scrubbing area of (say) 30,000 feet, generally there remains about 12,000 feet of such surface buried beneath the liquor;" this leaves only 18,000 feet above the liquor-line to deal with and purify the gas. It, therefore, obviously follows that when this 12,000 feet are liberated from the liquor and become exposed for active service to the gas, the washing and scrubbing power is increased by two-thirds. Hence, as we foreshadowed, a 3 million a day machine has sufficient surface available for contact with the gas to purify 5 millions; and a 4½ million machine is equal to 7½ millions, and so on. Such evident possibilities will doubtless be much appreciated by the gas profession at home and abroad, and provide an economical means for extensions of plant of this kind.

Another valuable result attained and pointed out by the adoption of this latest device is the easier and better-balanced manner

in which the several wheels of surfaces are caused to revolve, owing to the freedom obtained through their not having to overcome the resistance of the liquor through which, until the introduction of this invention, they had to pass. Also since the abandonment of this obstruction, the power to drive must be considerably reduced, as well as the liability of twist or strain to which the shaft is otherwise subjected—tending to its ultimate breakage. By the use of apparatus of this kind, greater concentration of the effluent liquor should certainly be secured, and a more near absorption of the carbonic acid from the gas be obtained. Further, as we have already observed, such an improved washer-scrubber should surely also be adaptable for employment in the purification of gas by means of causticized liquor.

One of the chief faults of the early plant used for the latter purpose was want of compactness and simplicity, whereby much loss of ammonia was sustained; and considering that this latest apparatus contains in a comparatively small compass so great a wetted surface, it may fairly be described as a compact design; while, by the simple manipulation of the cocks, the machine can, in emergency, be worked temporarily on the present lines. As the inventor sets out in the earlier part of his specification, the distinct advantages are that, "there being a much larger open area for the passage of the gas, less pressure is given; the gas travels slower, and is kept longer in contact with the surfaces; by doing away with the resistance caused by the immersed wheels, less strain is on, and less power required to drive the shaft and the wheels of surfaces it carries; weak liquor can be put into any bay and worked up to enhance its value; and ground space is largely saved."

These are some of the advantages claimed over the old type of rotary gas washer-scrubbers; and altogether this latest development appears to have brought rotary washer-scrubbers up to a very high degree of excellence—at all events, so far as using all the surface enclosed in the vessel to the highest possible pitch. Mr. Samuel Chandler, who for so many years has been and is a well-known and acknowledged successful worker in this class of gas purifying apparatus, is certainly to be congratulated upon bringing it to a much nearer state of perfection.



Chandler's Latest Patented Washer-Scrubber.

The patent referred to above is No. 27,841, dated Dec. 22, 1908, and was granted to Samuel Chandler, of Brixton Hill, S.W., for "Improvements in Apparatus for Gas Purification."

In his specification, the patentee says his invention relates to apparatus wherein a series of washing devices is arranged in bays or compartments and mounted upon a common shaft, and through which compartments the gas is usually caused to successively traverse and flow radially through the washing devices from the centre to the circumference, or from the circumference to the centre, and wherein provision is made for spraying water over such washing devices, so that as they are revolved they are constantly retained in a wet condition. He arranges in conjunction with each compartment a sump or receptacle into which the liquid which drains off the washing devices will be collected; the liquid so collected being lifted by a pump, and again sprayed on to one or other of the washing devices. Means also are provided whereby the washing liquid can gravitate from sump to sump.

Fig. 1 is a sectional side view of the apparatus. Fig. 2 is a section on the line X of fig. 1. Fig. 3 is a sectional side view illustrating a modification of the apparatus.

The bays or compartments of the apparatus have in them washing devices mounted on a common shaft, which extends through the apparatus and has bearings at the ends. Each of the washing devices is preferably composed of a series of sections E, carried by hubs or bosses F secured upon the shaft. As shown, these hubs or bosses are made hollow, and are connected in pairs, so that the gas which enters one compartment flows through one washing device from the periphery to the centre and thence into another device, through which it flows from the centre to the circumference, and so on.

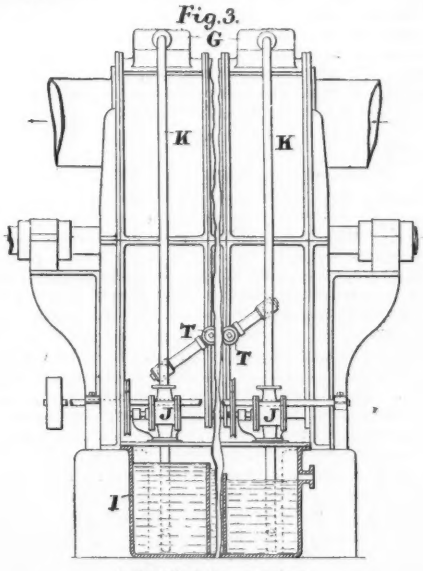
At the top of each compartment or bay is arranged a chamber G, having a perforated bottom H, through which liquid will be sprayed on to the washing device. At the lower part of each bay is a sump or receptacle I into which the liquid which falls off the washing devices drains. In connection with the receptacles I are pumps J, which draw the liquid away from the receptacles I and delivers it through pipes K into the chamber G, from which it is sprayed on to a rotating washing device.

The several receptacles I are connected by pipes L through which the liquid can overflow from one vessel into the next, and so on; each overflow pipe being connected at one end to the lower part (from which liquid overflows) and at its other end to the vessel into which the overflow runs, so that the denser liquid is discharged from the lower part of each receptacle into the next receptacle, and so on.

The arrangement of these receptacles and overflows is such that the washing device in the compartment into which the gas first enters will be wetted with a dense liquid, while that in the compartment from which the gas escapes will be wetted by relatively clean liquid.

In order to provide for the working of the apparatus in case of accident to the pumping or spraying arrangement, there is a second set of overflow pipes M, arranged at a much higher level than the pipes L, so that the apparatus can be worked with the washing liquid in the bottom of the compartments in the ordinary manner.

To provide for the proper working of these overflow pipes, however, it will be necessary to prevent by means of cocks the flow of the liquid through the pipes L.



A Modified Arrangement.

In adapting the invention to existing washer-scrubbers, the patentee provides the alternative arrangement shown in fig. 3, where the receptacles I, instead of being arranged immediately beneath the main compartments, are separated from them, and are connected with their respective compartments by pipes. The tank I may be common to all the washing compartments—being simply provided with partitions at varying heights, so as to dispense with the necessity for using the overflow pipes T. With this arrangement also, the pipes M, for affording connection between the respective bays when the washing devices are working with immersion instead of with the spray, are arranged outside the apparatus; each connecting pipe being provided with a cock for closing it when not in use.

WATER LEGISLATION FOR 1909.

[Second Article.]

In the "Journal" for the 2nd inst. the Acts obtained by Water Companies this session were noticed. We deal to-day with some of the measures of Local Authorities containing proposals in regard to water supply.

The Derwent Valley Water Act enables the Derwent Valley Water Board to make a deviation of an aqueduct, authorized by their Act of 1904, commencing in the parish of Morley and terminating in the parish of Hopwell. The Board are granted an extension by five years, from the 9th of August last, of the period specified by section 63 of their Act of 1899 for the completion of the Howden reservoir; a further period of three years from the passing of the Act for the purchase of certain land; and a like period from the first-named date for the completion of works by the Leicester Corporation under the Act of 1899. So much of section 147 of that Act as relates to the Hall Gates low-level reservoir is repealed, and authority is given for the work to be proceeded with, notwithstanding the expiration of the period of ten years mentioned in the section. The Act contains various financial provisions affecting the Board as well as the Leicester and Sheffield Corporations. [*Parliamentary Agents: Messrs. Dyson and Co.*]

The Llanelly Water Act empowers the Llanelly Urban District Council to construct and maintain additional water-works, and define and extend their limits of supply. The works consist of seven pipe-lines, which are to be completed within five years from the passing of the Act; and the proposed extension of the water area will take in certain specified proportions of the parish of Llanelly Rural. Authority is given for the purchase of mains and pipes within the extended limits. After the completion of the filtration works authorized by the Act (for which three years are allowed), all water supplied by the Council from their existing reservoirs is to be efficiently filtered before it is put into the mains for distribution for domestic purposes. Power is given to hold lands necessary to prevent the fouling of water, to fix and maintain meters and other apparatus for the detection and prevention of waste, and to make bye-laws in connection therewith. The Council are authorized to borrow £8175 for the purchase of lands, £12,925 for the construction of works, £41,700 for the extension and improvement of the water undertaking, and the amount necessary for defraying any purchase-money and compensation payable in respect of the acquisition of mains and pipes from the Rural District Council. For the repayment of the two first-named sums, sixty and forty years are allowed, and thirty years for the remainder. The Council are not to supply water within the Burry Port district, except to the Council, without the consent of that body. [*Parliamentary Agent: Mr. A. Rhys Roberts.*]

By the Northallerton Water Act, power is given to the Urban District Council to construct additional works, consisting of an impounding reservoir to be formed by a dam or embankment across the stream known as the Oak Dale Beck, five conduits or pipe-lines, two catchwaters, and other works; and to borrow £14,100 for carrying them out, and for the purchase of lands and wayleaves—to be repaid within sixty years so far as the money borrowed for the reservoir is concerned, and within forty-five years for the rest. A period of ten years was asked in the Bill within which money borrowed to defray the costs and expenses of the Act must be repaid; but only five years have been allowed. All water supplied by the Council is to be properly and effectually filtered or otherwise treated so as to prevent it acting on lead in such a manner as to endanger the health of the consumer; and they are to be liable to a penalty not exceeding £10 a day for default. [*Parliamentary Agents: Messrs. Dyson and Co.*]

The Oldham Corporation Act confers power upon the Corporation to construct additional works, comprising a pumping-station with a receiving tank in the parish of Butterworth, in the urban district of Milnrow, in the county of Lancaster, two aqueducts or pipe-lines, and a line of steam-pipes from the Butterworth Hall Colliery of Messrs. Platt Bros. and Co., Limited, to the above-named pumping-station—all to be completed within five years. The Corporation are authorized to borrow £20,200 for the purchase of lands for water-works purposes, as well as £75,000 for the construction of the water-works authorized, and for new mains, extensions, service-pipes, and meters; to be repaid in sixty and thirty years respectively. The water-rent for other than domestic purposes outside the borough is not to exceed by more than 13⅓ per cent. the rent payable for a similar supply within the borough. The prices per 1000 gallons of water supplied by measure are to be: Under 50,000 gallons per quarter, not exceeding 2s.; above 50,000 and under 500,000 gallons, 1s. 6d.; above the latter quantity, not more than 1s. The minimum is 5s. per quarter. [*Parliamentary Agents: Messrs. Lewin, Gregory, and Anderson.*]

The Act obtained by the Risca Urban District Council authorizes the transfer to them of the undertaking of the Western Valleys (Monmouthshire) Water and Gas Company, confirms the construction of the existing water-works, and sanctions the carrying out of subsidiary works and the supply of water and gas in their district and in adjacent places. The present works consist of a reservoir, a tank in the parish and urban district of Risca, six intakes, and seven conduits or pipe-lines. The limits of water supply are the whole of the urban district of Risca and a portion of the urban district of Mynyddislwyn. The rates chargeable are to be based on the rateable value of the premises supplied. Where this is not higher than £4 per annum, the charge is to be 2d. per week; above £4 and up to £7, 3d.; above £7 and up to £10, 4d. Premises rated higher than this are to be charged upon a percentage, decreasing with the increase in the value. For an extra closet 7s. 6d., and for a fixed bath 10s. 6d. per annum may be charged. The price of water supplied by meter is not to exceed 1s. 6d. per 1000 gallons. Authority is given to borrow such sums as may be necessary for the purchase of the undertaking and lands and waters for the purposes of it, and such sums as the Local Government Board may sanction for the extension of the works, providing working capital, and defraying the costs and expenses of the Act. The money borrowed for the purchase is to be repaid within forty years, and for the lands and waters within sixty years, from the date or dates of borrowing. The other water clauses are of the usual character. [*Parliamentary Agents: Messrs. Lees and Co.*]

The Stourbridge and District Water Board Act constitutes and incorporates a Water Board for the urban districts of Stourbridge, Lye, and Wollescote, in the county of Worcester, and Amblecote, in the county of Stafford, and the rural district of Kingswinford, in the latter county; and authority is given for the transfer to the Board of the undertaking of the Stourbridge Water Company, and for the construction of additional works. The Board is to consist of twelve members, who are to be elected within eight weeks from the date of the passing of the Act, or within such further time as the Local Government Board shall allow; and they are to remain in office until April 28, 1911. The method of election, the conditions of membership, and many other matters bearing upon the constitution and duties of the Board and its officers, are fully set out in the Act. The consideration to be paid for the undertaking is to be such an amount of Stourbridge and District redeemable water stock as will yield an aggregate dividend equal to the maximum dividends on the capital of the Company to which the shareholders were entitled at the date of the Provisional Order of 1908, *plus* £2000 of such stock. The construction of the existing works is confirmed, and authority is given to make new ones, consisting of a pumping-station in the urban district of Stourbridge, a covered reservoir in the township of Upper Swinford, in the same district, and three pipe-lines—all to be completed within five years from the passing of the Act. The limits of supply are to be the respective districts of the Stourbridge, Lye and Wollescote, and Amblecote Urban District Councils, the parishes of Pedmore, Hagley, and Clent, in the Bromsgrove rural district, and a portion of the parish and rural district of Kingswinford. The charges for water are to be based on the rateable value of the premises supplied; the minimum being 6s. per annum without a closet and 7s. with one. Extras are allowed for an additional closet or a bath. Where water is furnished by meter, the price is not to exceed 1s. 6d. per 1000 gallons. Borrowing-powers to the amount of £10,800 are granted for the purchase of land and the construction of works; £5200 for new mains, extensions, services, &c.; £2000 for working capital; and whatever sum it may be necessary to pay the Company in connection with the transfer of their undertaking and to defray the expenses of the Act and of the Councils' opposition to the Order of 1908. The Act confers the powers usually granted to suppliers of water. [*Parliamentary Agents: Messrs. Lees and Co.*]

The Wakefield Corporation have been granted an extension, by ten years from the passing of their Act, of the period limited by the Act of 1889, as amended by an Act of 1899, for the completion of such of the works thereby authorized as have not been finished. The other provisions relating to water supply contained in the present Act include power to proceed against persons who wilfully injure meters or fittings. The Corporation may borrow £150,000 for the completion of the works indicated, to be repaid within sixty years. [*Parliamentary Agents: Messrs. Sharpe, Pritchard, and Co.*]

The Watford Urban District Council Act authorizes the Council, among other things, to extend their limits of water supply so as to include as much of their district as is not at present within the limits of the Colne Valley Water Company. Power is given to maintain the present works and construct others, consisting of a well and pumping-station adjoining those now existing, a reservoir in the parish of Bushey, a conduit or pipe-line connecting them, and another leading from the reservoir to the junction of High Street, Watford, and the St. Albans Road. A period of ten years is allowed for carrying out these works. The rates for the supply of water are to be based upon the rateable value of the premises; 4s. per annum where this is less than £4, and 5 per cent. where more. The Council may supply water for other than domestic purposes by measure, at a price not exceeding 1s. per 1000 gallons; but they are authorized to charge for each supply (except in the case of houses partly used for trade) not less than 10s. per quarter. Borrowing powers are granted as follows: For the purchase of land and construction of reservoir, £14,190; for the erection of pumping-station, machinery, buildings, &c., £86,438; and for water-softening plant, &c., £9900—to be repaid in sixty, thirty, and twenty years respectively from the date or dates of borrowing. [*Parliamentary Agents: Messrs. Baker and Co.*]

At the inaugural meeting for the present session of the Junior Institution of Engineers, it was announced that the Durham Bursary for 1909-10 had been awarded to Mr. Frank J. Hawkins, the writer of the thesis on "Artificial Lighting."

LEWES'S IMPROVED INVERTED GAS-MANTLE.

THERE has lately been published the specification of a patent taken out in France by Professor Vivian B. Lewes, for improvements in gas-mantles.

The patentee points out that the ordinary Welsbach mantle generally employed in inverted incandescent gas-burners, which is composed of about 99 per cent. of oxide of thorium and 1 per cent. of oxide of cerium, furnishes a light too rich in violet and ultra-violet rays; the consequence being that the light is more injurious to the eyes than an artificial light which contains only a few of the ultra-violet rays, but a sufficient number of those at the red end of the spectrum to illuminate agreeably the surrounding objects. The patentee goes on to say that it is a well-known fact that mantles containing oxides of aluminium and chromium, either with or without the oxides of zirconium and thorium, produce the light just described. It was owing to this fact that, in the early days of incandescent gas lighting, many consumers preferred upright mantles made in accordance with this principle to ordinary Welsbach mantles. But, notwithstanding the agreeable light they emitted, and the lower cost at which they could be put on the market, they gradually dropped out of use because it was found that the mantle contracted and deteriorated near the top of the burner, in consequence of the great heat thrown off at the place where the inner cone—the green cone of the bunsen flame—came in contact with the tissue of the mantle, and caused volatilization of a portion of its constituent material. Various means were tried to avoid this inconvenience—for example, strengthening the edge of the mantle in order to prevent its contraction—but without obtaining satisfactory results. The consequence was that this type of mantle disappeared before the arrival of inverted burners.

The invention under notice consists in the utilization of the weight of the mantle in preventing its contraction and deterioration. This is effected by the use of a mantle such as that already described in combination with any kind of inverted burner. It will be readily understood that, by means of this arrangement, the heat is distributed equally over the entire surface of the mantle, and that the weight of the latter is sufficient to prevent its contraction. In the manufacture of these mantles, the composition which seems to produce the best results in practice is as follows:—

	Per Cent.
Oxide of aluminium	87
,, zirconium	4
Chromic oxide	9

Slight variations in these proportions do not, however, make a great difference in the quantity of light emitted by the mantle. Very good results are obtained by replacing the zirconium by thorium; and inverted mantles of excellent quality, so far as concerns their light-giving power, may be produced by means of combinations varying in the following proportions:—

	Per Cent.
Chromic oxide	5 to 10
Oxide of aluminium	48 ,, 60
,, thorium	42 ,, 35

In this combination, part of the oxide of thorium may be replaced by oxide of zirconium.

ILLUMINATING AGENTS.

A Sketch of a Lecture, with Some Comments.

THE fact cannot be disguised that the public do require educating in the matter of artificial illumination, and that the only qualified teachers are those who make a study of the question, whether they be independent experts (a title which few can at present claim), or the advocates of any particular system. It was with pleasure that we saw a large audience at the London Institution, Finsbury Circus, yesterday week, to hear a lecture on the subject (arranged for by the Committee) by Mr. Leon Gaster. During one part of the lecture, Mr. W. Williams, of the European Gas Company, presided. The character of the lecture was, of course, popular; but it had its good points for those who aspire to teach others. The lecturer practically devoted himself almost entirely to indoor illumination. He passed lightly over the history of the subject, to point the lesson of how vital had been the effect of good lighting, socially and industrially. The early pioneers in lighting, he mentioned, in a passing sentence, had much difficulty in their work; and he might have added that time has not lessened the difficulties of the illumination workers. The subject is such a big one now that it requires detailed study, and to be dealt with by the illumination expert. Light is the cause; illumination the effect. Effect is what a consumer pays for; and an expert's duty is to see that a consumer gets value in effect for his money.

The marked progress in electric lighting was next brought under review; the progress having culminated in the metallic filament lamp, in connection with which invention has not been exhausted. For the first time (he believes) in public, the lecturer showed a 16-candle metallic filament lamp for 200 volts. He then illustrated the effect of over-running incandescent electric lamps—increasing the voltage beyond the rating, and so obtaining augmented illuminating power, which would shorten life. He also demonstrated the incongruity of running lamps in series that are not properly paired. Then he had a shot at unscrupulous electric lamp manufacturers and vendors, who trade fraudulently on the public confidence by selling lamps improperly marked, and which lamps are not distinguishable by the non-technical from good varieties. Numbers of foreign lamps are known to be bought up cheap by British dealers, who subsequently mark on them their own fancy names. "The 'throw-outs' from the Continent have a very funny way of coming this way. They don't sell them on the Continent; they sell them here." The point he enforced is that there should be some means of compelling all lamps to be properly marked; so that wherever and whenever the user bought a lamp, he should know that the marking on it truly represented its capabilities. But the lecturer does not altogether absolve the public from participation in giving encouragement to wrong dealings of this sort. There are those who will adopt the "penny wise and pound foolish policy" of saving a few pence on the lamps, and wasting a good many pence as a consequence on the electricity consumed. Another point at which the lecturer had a gentle tilt was as to the claim of some makers of metallic filament lamps that they show a 70 per cent. economy. That, he said, is not the true economy, because the expense is not only made up of the current consumed, but, in addition, the cost of the lamp and the duration of its life. Though the electricity might not be expensive, if the lamp is expensive, and if it has a short life, the economy claimed is not there. With reasonable price and reasonable life lamps, the economy may be high; but the direct economy claimed is not borne out in practice. The consumer's position in regard to his lamps should be improved; and this can best be done by co-operation between the reputable lamp makers and the central stations. As it is, under the present condition of things, the consumers look upon their bills something in the same way that they do upon their income-tax papers. They do not like them; and the worst of it is they do not understand them.

The lecturer next had a fling at the deputation appointed by the City of London Corporation to visit the Continent to investigate systems of street lighting, though what this really had to do with indoor lighting was not explained. Of course, the great unpardonable sin of this deputation is that they did not take an expert with them. But the lecturer did not say that they had the advice of the experts of the municipal authorities in every city they visited. Had they taken an expert, who would Mr. Gaster have elected—Professor Vivian B. Lewes or Mr. Voysey? The work of the deputation, as the mass of information in their report shows, was not "mere ocular" demonstration. Nor can we see, looking at the constitution of the deputation, that in their case "the result of mere ocular demonstration depends upon whether one has had dinner or not." Mr. Gaster's point, of course, is that non-technical observations are of limited value. In a matter of this kind, he said, one has first to know what one wants to do; and then how to do it. There is, he says, a ready way of ascertaining this—through the expert. But the deputation came home, and recommended further experiment. This, the lecturer feels, is not the proper way to settle the street lighting question. We disagree. The whole of the members of the Corporation cannot be expected to give a vote one way or the other, without they have some ocular demonstration of the methods advocated by the deputation. We have not yet come to local government in any single matter being controlled by a single "expert"—professedly independent with a leaning. The importance, added the lecturer, of the decision of the City of London is that—not being owners of the gas and electricity supply—the selection by the Corporation of any system of street lighting will have an important effect on other communities who look to the City for guidance. Incidentally, the lecturer mentioned that in Stuttgart, he had seen a new method of suspending gas-lamps on wires spanning the street, after the manner recommended by the deputation.

Turning to gas lighting, Mr. Gaster confessed that he was again faced by a vast and interesting subject. He traced the improvements, in the superficial manner that time only admitted, from flat-flame burner to inverted gas-lamp. The early difficulties of this last form of burner have been overcome by the proper provision of gas and air regulators and mixing chambers. A number of burners had been kindly fixed up by the Gaslight and Coke Company in the otherwise badly electric-lighted hall, so as to demonstrate some of the advances made. Norden's "Airostat" burner was exhibited, as the latest production, in that it provides for the automatic regulation of the air supply. Such automatic regulation, the lecturer thinks, bids fair to mark progress in the means of artificial illumination. Then Mr. Blakey's "Twin-Burner" was shown, whereby the products of combustion from a lower inverted burner are made to pass into a vertical burner above, and, with a small addition of pure gas, are there utilized for incandescing a vertical mantle. The Lucas "Thermopile" lamp was exhibited, as showing a happy combination of electricity and gas. Here the lecturer produced one of the new gas lighters invented by Welsbach. The greatest advance of all, however, says Mr. Gaster, is high-pressure gas lighting, which is going to hold its own against ordinary arc lighting and in many places against the flame-arc lamp. It may be suggested that the new forms of high-pressure lamps can, where gas is at a reasonable rate, compete in all cases with the flame-arc lamp. Where it is not desired to put up compressing plant, there are the various self-intensifying lamps available. Oil-lamps by which the oil is vaporized, and burned in connection with incandescent mantles, petrol air gas, and acetylene, were noticed; and reference was made to the ability now to systematically apply lighting and extinguishing appliances to gas.

Then the lecturer came to that all-important question of cost

and also asked which among illuminants is the best means of illumination. He cannot give any categorical answer to the latter question that would be generally applicable. What is good for one is not always good for another. But as to cost, the lecturer quoted figures that should be modernized. For instance, 1¼d. per 1000-candle power per hour is not the price under the latest system of high-pressure lighting, using gas at 2s. 6d. per 1000 cubic feet. We suggest that Mr. Gaster should study the actual figures from a modern installation at West Ham as given on p. 396 (top of second column) of our issue for Nov. 9. Then the lecturer referred to the recent lifting of photometry from a state of bewildering uncertainty on to a more definite basis; and he then went on to allude to the necessity for good lighting in schools, factories, hospitals, and so forth—proper illumination being as important as good sanitation. The importance of scientific control of illumination, in order to, while giving the eyes sufficient light, avoid injury through glare, was emphasized. So, the lecturer went on, with information that impressed his hearers with the vastness of the subject of illumination.

Then we came to the crucial point. When doctors differ, who is to decide? Where are we to find the man of sufficient weight, knowledge, and varied sympathies to guide the user of illumination; a man unconnected with any system of lighting, and taking an impartial view of things; a man who can recognize not only the economical, but the physiological side as well; a man *sans peur et sans reproche*. Echo answers "Where!" And we leave the subject wondering in our minds, whether Mr. Gaster—the pioneer in the "impartial platform" movement—has ever professionally recommended an installation of incandescent gas lighting.

FUTURE OF THE ELECTRIC LIGHTING INDUSTRY

Suggestions for Combating Gas.

BEFORE the Institution of Electrical Engineers last Thursday, Messrs. Handcock and Dykes submitted a paper entitled "The Present Aspect of Electric Lighting." It might better have been called "Methods of Charging for Electric Supply," for the burden of the communication was to devise a means whereby the many small gas consumers might be tempted to transfer their custom to suppliers of electricity. In short, it is proposed to deal with such consumers by the introduction of a "contract" system—*i.e.*, a fixed charge of 12s. per 30-watt lamp per annum is to be made, inclusive of wiring rental for an all-day supply, and 10s. per lamp per annum for a "dusk to dawn" supply. Naturally, no meters will be installed; and in order to ensure that consumers connected on this system shall not change their contracted lamps for others of higher candle power, it is proposed to adopt a special form of holder, which can only be obtained from the supplying authority. The prices mentioned above are suggested as an average, though they may be varied according to the locality. Mr. G. Wilkinson, the Electrical Engineer to the Harrogate Corporation, has had such a system in use for a short time; the charge being 11s. per lamp per annum. By the general adoption of this method of charging, the authors anticipate an influx of long-hour consumers who have hitherto used gas; and they are sufficiently enthusiastic to claim that the system and prices are such that no gas company will be able to compete. An expression of opinion of special interest to gas companies is that short-hour consumers can never be remunerative to electrical undertakings; and engineers of supply stations are urged to concentrate their attention upon the long-hour consumer.

A lengthy discussion followed the reading of the paper.

Mr. Wilkinson said he had found the system quite successful at Harrogate—in fact, it was more remunerative than the ordinary flat-rate or maximum-demand system. He has consumers who have preferred to go over to the contract system, conscious that it will cost them more, for the reason that they know exactly what they have to pay. He pointed out, however, that the system could not be applied to heating and cooking; and he remarked that it would be waste of money to do anything of the kind in a neighbourhood where there were small houses, as it was possible to get as many British thermal units out of 6 cubic feet of gas as could be got out of a unit of electricity.

Mr. C. H. Wordingham (Electrical Adviser to the Admiralty) entirely disagreed with the system proposed. He advocated a sliding-scale, and regarded it as ludicrous to charge the long-hour consumer at the same rate as the short-hour one. If the conductors of electric undertakings chose to do this, they would allow the gas companies to go on for ever, and would never get any business away from them. He disagreed with "dusk to dawn" supply; and, speaking as an old central station engineer, said he was strongly of the opinion that the primary thing to aim at was continuity of supply. If consumers could not look upon electric supply in the same manner as they did water or gas, they would have none of it.

Mr. A. H. Seabrook (the Engineer and Manager of the Marylebone Electric Supply Department) agreed with the principle of the contract system, but did not like the "dusk to dawn" idea. He said there were hundreds of consumers in every district who used both gas and electricity, but when necessity arose they had the gas flaring all day and at night electricity came on. With a contract system it would pay these consumers to use electricity all day, for gas could not compete with electricity at 1d. per unit. This, of course, would have to be a "contract demand" system, with a small standing charge and a very low price per unit for the current supplied.

Mr. J. S. Dow wished to know how the authors had come to the conclusion that no gas company could possibly afford to utilize such a system as the one proposed in the paper. That afternoon he had been speaking to a leading representative of the gas industry, and he had told him that the gas people could afford to do it perfectly well; but very few gas companies would be induced to do it, simply because they had such a convenient and simple method of charging at the present time. As a matter of fact, in the early days of gas lighting, they adopted a similar system to the one proposed; but he believed difficulties had arisen in applying it to heating and cooking. It worked quite well for lighting, but with cooking it was very difficult to prevent people wasting.

Mr. H. A. Scott-Moncrieff (the Engineer to the Electric Supply Corporation) said it had often annoyed him very much to see gas-burners going all day. The best way to deal with this was to offer a contract system for the long-hour supply, and deal with the short-hour supply in the ordinary way, by meter.

Mr. F. Risch complained of electrical engineers grumbling at the effects of metal filament lamps. He said these had brought down the cost of electric lighting; and now that the price had been reduced, the very consumers to whom they had all been looking were to be regarded as unremunerative. One station engineer of his acquaintance was very jubilant when he started the new system, for he was charging 5s. or 7s. 6d. per lamp per quarter and 1d. per unit; but he (the speaker) had warned him that he would not be able to do this for long, for their "friends the enemy"—the gas company—would soon be going around to the customers and telling them how they were being robbed. Electrical people were too scientific; they were not commercial enough. A speaker had just said something to the effect that gas companies could do anything the electric light people could do; and he believed it. The gas people did not scoff at the small consumer. They put in a slot-meter for him; and the dividends of gas companies went up by leaps and bounds in consequence. And these were the small consumers which the authors suggested they should leave alone.

Mr. H. Hirst thought there was no need for panic measures on the part of engineers and managers of supply stations in consequence of the introduction of metal filament lamps, which enabled a very effective attack to be made upon the £26,000,000 revenue which the gas companies prided themselves on getting from small consumers. Once a cheap wiring system was available and a better supply of lamps, wonderful progress would be made in this direction.

Mr. H. W. Handcock, who replied to the discussion, said it was not the authors' intention to change over every consumer to the new system right away. What they said was that, owing to the new conditions that had prevailed since the introduction of metal filament lamps, electric undertakings were in a position to supply a large number of consumers, hitherto using gas, at a price which would make it more profitable to them to use electric light. He claimed that this could be put to such consumers on the score of economy alone; but metal filament lamps also enabled the suppliers of electric light to give better effective illumination at a price which compared favourably with that which gas consumers were now paying. It was not so much a question of changing over existing consumers, as some speakers seemed to think, as of opening up an unexplored field for electricity.

Statistics of Scottish Gas Undertakings.

In the notice of the report of the proceedings at the last annual meeting of the North British Association of Gas Managers which appears elsewhere, it is mentioned that following the technical matter is the Statistical Report of the Gas Supply of Scotland for the twelve months ended the 15th of May last. Our readers may remember that this report has for some years been included in the annual volume of "Transactions." This year, however, it has undergone several very interesting changes. Mr. Hislop, the Secretary and Treasurer of the Association, who has the preparation of it, has omitted thirteen undertakings with regard to the working of which information has not hitherto been given. On the other hand, he has added eight, some of which have newly come into existence. He has dropped the columns recording the maximum night pressure and the day pressure at the governor outlet, these items having no longer their former interest, and has added columns in which are given the number of ordinary and slot consumers, the number of cookers, the mileage of mains, and the illuminating power of the gas supplied. According to the report, there are 236 gas undertakings in Scotland; and the managers of 152 of these undertakings are members of the Association. This leaves a large number who are outside. But they are managers of the smallest gas-works, and their absence can scarcely be called a loss, except to themselves. It is matter for regret that there are as many as 42 undertakings in regard to which information is not furnished; and of these, it may be mentioned, there are eight under the management of members of the Association. Mr. Hislop deserves the thanks of all for the interest he takes in the production, and for his care in the keeping of it accurate and up to date.

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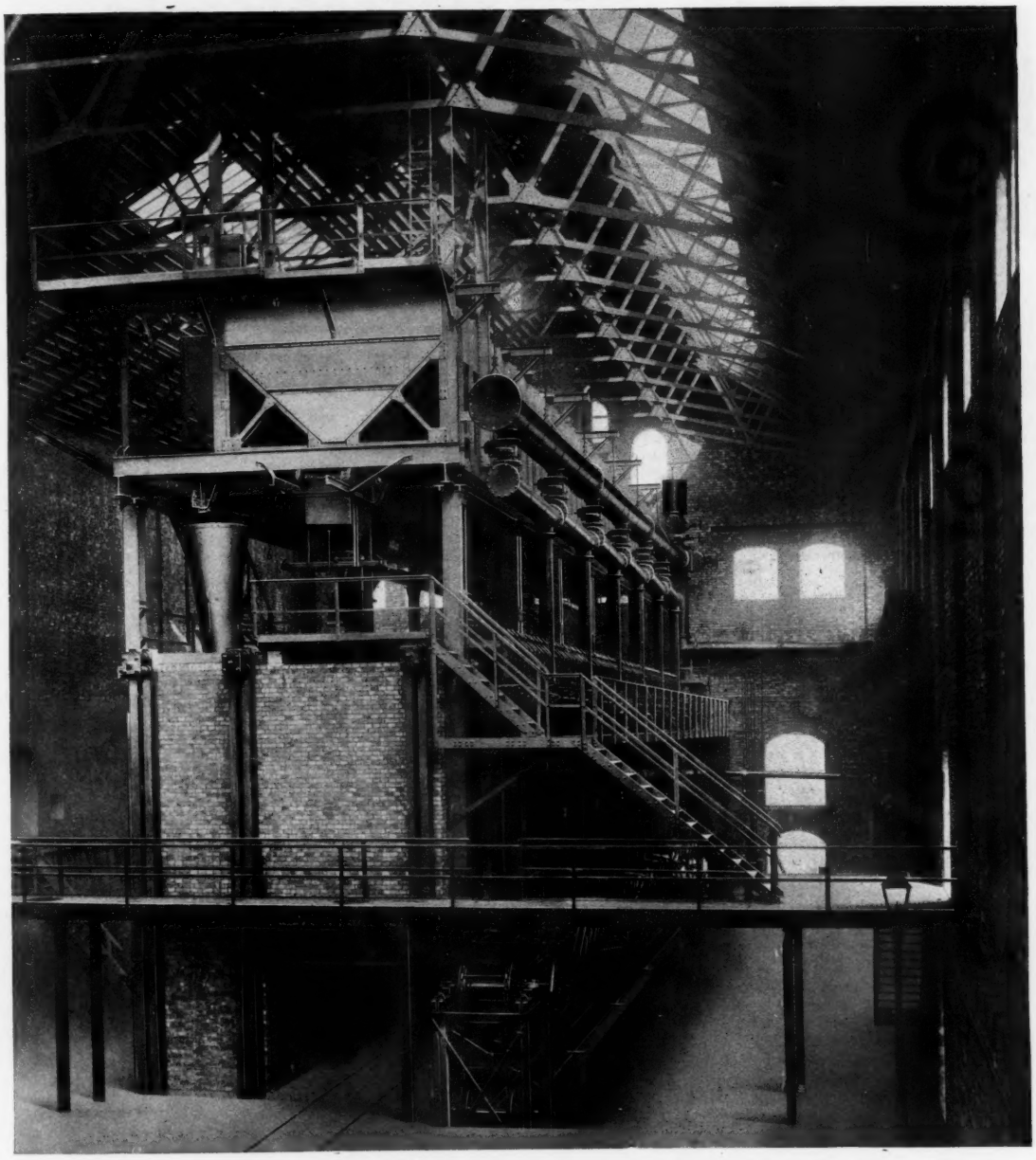

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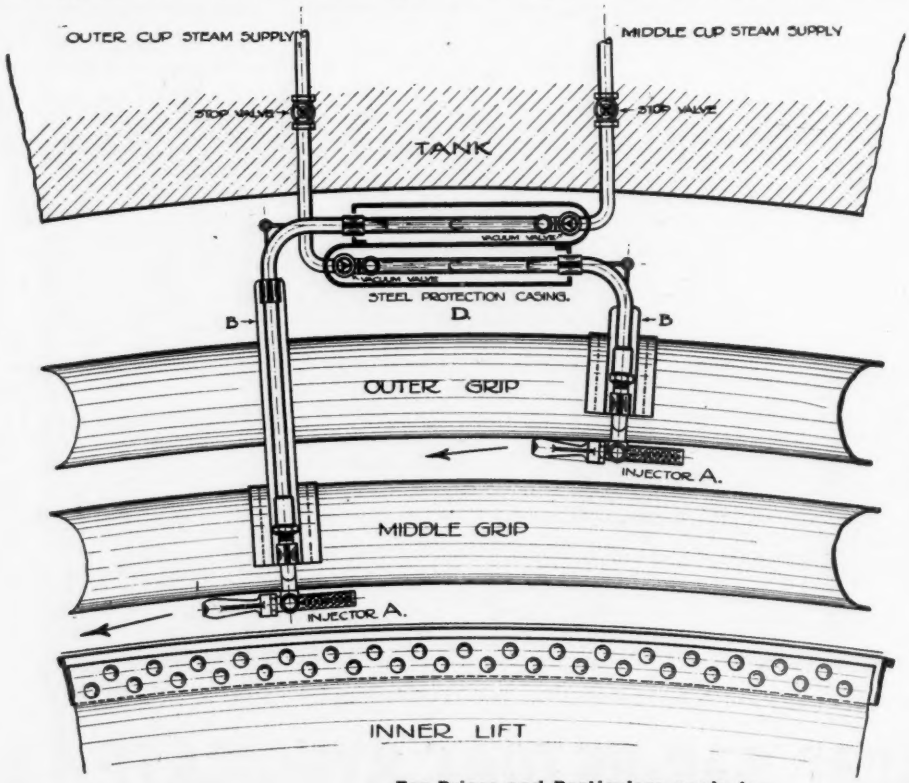

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SOCIETY OF BRITISH GAS INDUSTRIES.

The Autumn Meeting of the Society was held last Tuesday, at the Waldorf Hotel, Aldwych—the PRESIDENT (Mr. Thomas Newbigging) in the chair. There was an excellent attendance of members, together with visitors, including the President of the Institution of Gas Engineers (Mr. James W. Helps, of Croydon), and certain of the Presidents of the District Associations of Gas Engineers.

The SECRETARY announced that letters of apology had been received from, among others, Sir William B. Richmond, K.C.B., R.A., President of the Smoke Abatement Society, Sir William Bull, M.P., Mr. J. H. Balfour Browne, K.C., Mr. Corbet Woodall, Mr. Charles Carpenter, Professor Vivian B. Lewes, Dr. William A. Bone, F.R.S. (Leeds University), Professor John Graham (Manchester University), the two Vice-Presidents of the Institution of Gas Engineers, some of the Presidents of the District Associations, and Mr. Doig Gibb.

THE PRESIDENT-ELECT.

Mr. CHARLES CLARE (the Chairman of the Council) announced that the Society had been very fortunate in having obtained the consent of Mr. J. H. Balfour Browne. K.C., to take the presidency in the coming year. [Applause.]

SOME POINTS FOR CONSIDERATION.

The PRESIDENT then delivered the following address:

Gentlemen,—As President of the Society, I feel it my duty, at times, to look at matters from your point of view, sinking to some extent my own individuality as an engineer who has usually to confront you on behalf of clients, and trying to realize some of the obstacles, or the difficulties, or the discouragements, which you meet with in the course of business.

On some of the points with which I will deal, most of you would hesitate to speak your mind, fearing that in so doing you might injure your custom. I have no such ground of hesitancy, so long as I feel that the necessary word ought to be spoken.

THE PRECIOUS GIFT OF TACT.

There is a special variety of the genus engineer to whom I have often yearned to offer a word of advice. Those to whom I refer may be clever and conscientious; but they are also great martinets, and sadly wanting in that most precious gift of tact.

I have occasionally come in contact with these in the course of business, both in gas matters and in other spheres of operation. I am not referring to engineers in the gas industry alone, but also to some engineers outside it. They make up their mind from the outset, when they are having any kind of work done by contract, to look upon the contractor as a natural enemy who needs carefully watching and tying down with the utmost rigour to the performance of the veriest trifle, without giving him the slightest assistance or encouragement, and as though the whole success of the work when completed depended on the rectification of (say) some small defect which the contractor had probably overlooked without any intention to evade his responsibility.

I have known poor contractors harried out of their very lives with such small-minded men, and the payment of their instalment money, or their retention money, postponed unreasonably on this account. If a bolt is found to be loose which the turn of a key would remedy, or if a slight crack in the brickwork appears through which a puff of smoke is issuing, and which would be stopped by a dab of cement laid on with a trowel-tip, or other such trifling defect, they make no end of a list of delinquencies on the part of the contractor for which they claim abatement from the contract amount, and almost force their Committee or Directors to believe that they have had an arrant rogue to deal with throughout the job, and but for his (the engineer's) vigilance they would have been defrauded to any extent. Men of this kind often land their employers in arbitrations and law-suits that cost hundreds of pounds, which a little tact and the expenditure of a few shillings at the outset would have prevented.

My experience as an engineer is that if you want a good job doing, and with as little friction as may be, you should make a friend of the contractor (if a man of repute), and even give him an odd lift if a difficulty arises which you can readily help him to solve. Mutuality of this kind is a policy of insurance tending to peace of mind on both sides and the obtaining of a good result. I have known the fair fame of honest contractors being seriously damaged by such sticklers for modicums that amount to nothing in reality. Happily, they are in the minority; most engineers taking a broad-minded view of their position and duties.

ENGINEERS AND ENGINEERS.

There are various abuses which place the members of this Society at great disadvantage, and which the council may well discuss with a view to devising a remedy.

For example: There is the practice largely followed by certain engineers in these degenerate days, who, instead of themselves preparing a specification and drawings and taking out quantities for the apparatus they require or the work they wish doing, ask (say) half-a-dozen or a dozen firms to send in specifications and drawings. The final result, of course, is that five out of the half dozen, or eleven out of the twelve, have laboured in vain and spent their strength and money for naught; for the engineer in question would open his eyes very wide indeed if he received an account from each of the unsuccessful competitors for the time and labour expended on the specifications and drawings they had been invited to prepare and send in.

If an engineer asks for specifications and drawings, good and well; but let make-believe cease and let the obligation be owned. A charge should be made and paid to every firm, whether successful or not, who has submitted designs by request. There is no hardship in this; the hardship is that firms should be mulcted of their due.

By and by, when the contract is completed and the machinery, or apparatus, or plant has been put to work, a report of the inauguration ceremony appears, where it is stated that the whole has been executed to the designs and under the supervision of Mr. So-and-So the engineer, Messrs. So-and-So having been the contractors. This is obtaining credit under false pretences. The system is rotten at the core. There can be no independence on the part of the engineer, and no real confidence on the part of his employers under such conditions. The matter is on a different footing where a firm has a speciality, whether protected by patent-right or not. In such case the firm may be expected to supply the details of their special work or appliance.

AMENDED TENDERS.

There is also the iniquitous system practised, oftener by local authorities than companies—though the latter are not always blameless—of asking for "amended tenders" from firms who have submitted a tender, in response to advertisement or otherwise, and who have already, in face of trade competition, cut down their price to a point which leaves but a bare margin of profit on the job. Any reduction, as the parties believe, is so much money saved; not realizing the fact that a policy of this kind is a direct encouragement to the cutting-down of strengths and quality, along with the turning out of less perfect workmanship than would otherwise have been put into the contract.

The remedy for these barefaced abuses is in the hands of the members of the Society; and it is quite certain that if they made a compact to put an end to them, and remained faithful to each other, a different state of things in this respect would very soon prevail.

TENDERS INVITED BY LETTER.

Again, when a set of drawings, specification, and quantities have been prepared by the engineer, and he receives instructions from his Committee to invite by letter—not by public advertisement—tenders for the work from a specially selected number of manufacturers or contractors, it seems only reasonable and fair in such case that the lowest tender shall be accepted. This is by no means always done, as I know from actual knowledge; though I consider, as a point of honour under such circumstances, that the firm whose tender is lowest ought to be successful, and that they have a just grievance at being passed over. When tenders have been invited by open advertisement, the case assumes a different aspect.

THE POOR INVENTOR.

The wise man tells us that "the way of the transgressor is hard." I often think that the lot of the inventor is harder still. Occasionally he receives the encouragement which is his due, but in nine cases out of ten it is otherwise.

A man (say) realizes that a certain apparatus or process in gas manufacture and supply—or in any other department of industry—might be greatly improved in efficiency, and he sets to work to accomplish that end. A solution may spring upon him suddenly; but, as is more generally the case, he spends his days and nights in study and experiment, until at length, after the expenditure of much effort and no little hard cash, he has arrived at the point when his invention may be secured by letters patent.

> "I had toiled at it, Sir, every night for a year,
> So hopeful and happy in seeing my thought
> Turned now into fact, and coming out clear;
> At last, through a plain inspiration I got:
> For why should not God inspire minds to invent
> As well as to preach, and be praised for His gift?
> Sir, it came like a flash and a thrill that were sent
> In a moment of failure, when I was adrift."*

Is he, then, at the end of his quest? In one sense, yes. In another, far from it. Although the new and better process he has invented, or the improvement which he has effected, may be perfectly obvious to all who examine it, yet there is no haste to adopt it. Its ingenuity is recognized, but the old and less efficient methods suffice and are retained, and the inventor of the new and better method is relegated to neglect. He has apparently spent his strength and his means and got no return. No wonder if he loses heart, and, if he lacks the capital or assistance to work it himself, parts with his invention for a tithe of its value to someone who has the means of exploitation. Before many years have elapsed, he has the melancholy satisfaction of seeing the widespread adoption of that which his ingenuity and toil produced, and the pecuniary benefits reaped by others. I need not quote instances, they will recur to most of you.

Many gas authorities prefer to lie low and wait developments rather than lend a helping hand towards the success of an invention. To say the least, this is not an admirable spirit, however well it may accord with the parsimonious views of those who

* "Dick Dalgleish," by Walter C. Smith.

pride themselves on being wise in their generation. There ought to be more readiness on the part of gas companies, and gas authorities generally, to encourage any worthy inventor, by giving his invention a fair trial on such adequate scale as would prove its value or otherwise. The risk of doing so would not be great; the advantages to be gained might be many and profitable.

Much has been said, and much more might be spoken, in favour of the endowment of research. The country that wisely adopts it will reap advantages a hundred fold. Bacon says that "among all the benefits that can be conferred on mankind, I find none so great as the discovery of new arts, endowments, and commodities for the bettering of man's life." If that be so, it is not reward enough to the poor inventor to leave him to "the consciousness of well-deserving," and to that only.

Vertical Retorts.

Speaking of inventors and inventions, I must make mention briefly, of the impending change that is likely to take place in our methods of carbonization. I refer to the system of vertical retorts at which a number of ingenious minds have been at work. I have not yet had the opportunity of viewing the Dessau system in operation, nor that of Messrs. Woodall and Duckham—though we may shortly have the opportunity of seeing both of these on a considerable working scale at Sunderland and Burnley respectively; but I have recently seen that of Messrs. Glover and West at the St. Helens Gas-Works, and I am impressed by the evident efficiency, and not less by the simplicity, of the whole arrangement and its details.

On the general question of carbonization in vertical retorts, the striking features about it are that the system (in the case of two of those mentioned) is continuous; there is no time or heat lost in charging and drawing; there is a greatly increased production on a given space area, with a larger yield per ton of coal carbonized, and an absence of nuisance in the operation. But the most remarkable thing about the process is that the services of the twin giants—"Manual-Labour" and "Machinery"—are almost dispensed with—or at least dwarfed to the very minimum—so far as charging and discharging are concerned, gravity being the mainspring of action. There are other minor advantages, but those mentioned are the salient points that will appeal to every gas engineer. We are not able yet to speak definitely as to capital cost nor as to durability—the latter has to be proved by efflux of time; but, so far as one may judge, these are more likely than otherwise to exceed in economy all existing carbonizing appliances.

Of course it will take time to supplant the methods and machinery at present in use, because existing appliances will not be "scrapped" immediately. But in my opinion the new system of carbonization in vertical retorts will have a steady and continuous growth. It is satisfactory to know that British inventors are not lagging behind in the race.

American Experience.

Since we last met, I have had the pleasure of a professional visit to Canada and the United States. It was gratifying to me to see while there that the gas machinery apparatus and plant of British makers are held in high estimation by our kinsmen across the sea. Without mentioning the names of firms, many of whose representatives I see before me to-day, I may say that I saw British-made appliances of such excellence and efficiency that they do not suffer, but rather gain, by comparison with what are produced on American soil.

I could not but observe this also, that, much as we admire, and justly admire, the spirit of enterprise and strenuous endeavour which meets us on all hands in the New World, there still remains this to be said—at least as regards the apparatus and plant with which the members of the Society are mainly concerned—that there is a lack of originality displayed by our friends of the Continent of America. I make an exception of the "Bronder" charging and drawing machinery in use in many gas-works both in the United States and Canada. This remarkable machinery draws and charges four retorts at once. I saw it at work and timed the operations. The four retorts were drawn in forty-two seconds and charged in twenty-four seconds, and that, too, with the utmost precision and ease. In this respect it will be admitted that our cousins are ahead of us. Perhaps also they beat us at inventing what are termed "wrinkles"—the invention of small, natty, useful expedients and things; but the evidence is plain to any expert that, as a rule, their imitation of your work is rampant.

No doubt in certain respects they improve upon our makes and methods, and in that way surpass us to some extent, but the fact is patent that their root ideas are of British parentage.

"Full steam ahead," however (very often "with a nigger squat on the safety valve"), is the motto across the herring pond, and we shall only continue to hold our own if we are alert, and enterprising, and progressive; not slow to adopt new ideas while improving on the old. Otherwise, there is danger of our being left behind in the march.

One thing amongst many struck me forcibly; labour-saving appliances are universal, be the cost what it may. But, like the application of the steam-hammer to the cracking of a nut, the suggestion occurs to me whether this labour-saving craze is not sometimes overdone in regard to matters of comparatively small importance.

Progress of the Society.

I am glad that the Society continues to make progress, and that there is an increase in the membership. It cannot, from the nature of things, be expected that there should be a large yearly influx of members, because the majority of those engaged in your special industry became members at the outset. But there are still some important firms outside who may find it to their interest to come in. Whether this may be so or not, there must be no flagging of interest on the part of those already composing the Society. Let every individual member bear his share in promoting its welfare and usefulness. Its effects for good may well be far-reaching, but only to the extent which you determine they shall be, and work to that end.

Above all things we should be on our guard against allowing our minds to become stereotyped—imagining that perfection has been reached in any one process or appliance. That is to stagnate, to go to sleep in our methods. In such a frame of mind the chances are, that, like Rip van Winkle, after the lapse of years we shall wake up to find that the old faces (methods) which we once recognized and swore by have vanished from our ken and we are left behind, stranded in the shallows of a bygone time.

"My grandfather was a most wonderful man," as the old song has it, but we have outlived his ideas; the world has progressed in the interval since the days of our grandfather, however wonderful he may have been, and no doubt was. One of the great objects of the Society is to stimulate its members to keep abreast of the times, and so prevent the stagnation which isolation is apt to encourage. Let us, therefore, feel that all our best achievements are but stepping-stones to greater things. These are not too strong expressions to use in regard to a Society such as yours. Defoe was right when, two hundred years ago, he declared that Trade and Industry were the foundations of England's greatness, and that success in Trade was the most honourable patent of nobility. That was true in his day, and it is no less true in these later times of Sturm und Drang.

Some Legal Aspects of the Smoke Nuisance.

Mr. C. E. Brackenbury, Barrister-at-Law, then read a paper on the above subject. Extracts from the communication, together with a condensed report of the discussion, appear in another part of the "Journal," pp. 601-05.

Dinner, and Some After-Speeches—Co-operation.

The members dined together in the evening, with the President in the chair; the vice-chairs being occupied by Messrs. Harry J. Donkin, Fred. J. West, Hugh F. Wright, Thomas G. Marsh, J. W. Broadhead, and Charles Clare. At the top table to the right-hand side of the President, were the following: Commander W. J. Caborne, C.B., Mr. Dugald Clerk, F.R.S., Mr. J. W. Helps, Mr. S. Y. Shoubridge, Dr. H. A. Des Vœux, Mr. F. W. Goodenough, Mr. Laurence W. Chubb, and Mr. R. Bruce Anderson. To the left-hand side of the President were Mr. D. Milne Watson, Mr. John W. Morrison, Mr. James Paterson, Mr. T. H. Duxbury, Mr. C. E. Brackenbury, Mr. W. T. Dunn, and Mr. A. L. Griffith.

After the loyal toasts,

Commander Caborne gave the toast of the "Society of British Gas Engineers." He commented on the large field of theoretical, practical, and scientific work, whether looked at from the point of view of the engineer or the chemist, that the Society occupied. He had read the address of the last President (Sir George Livesey), whose death had been a great loss both to capital and labour, as well as the Inaugural Address of Mr. Newbigging; and he was struck by the lofty ideals pervading the two addresses. That afternoon, they had listened to an able paper and discussion on the "Legal Aspects of the Smoke Nuisance." He thought every engineer would agree with him that where there was emission of smoke from the shops of manufacturers, it was owing to inattention, and was simply waste. It showed there was imperfect combustion. As a member of the Executive Committee of the Smoke Abatement Society, he might mention that classes for stokers had been formed, because one of the factors contributing to the smoke nuisance was bad stoking. He was happy to say these classes were an unqualified success. During the discussion that afternoon, Dr. Brackenbury stated that he knew of certain invalids who came to town in order to breathe London fog in the winter time. With great deference, he might say that coal smoke was always inimical to health; and it was also a disadvantage in that it deprived people of a great deal of sunlight. The smoke was detrimental to property, too, and to plant and shrub life. Their President, in closing the discussion, stated that it would be impossible to have any legal enactment prohibiting smoke from chimneys. He (Commander Caborne) understood that such a prohibition existed in New York; and what had been done there might be done here. This would bring into common use smokeless fuels, among which would be in the very front gas and coke. He had sincere pleasure in proposing the toast, and in hoping the Society might expand greatly in usefulness.

The President, in responding, thanked Commander Caborne for his wise words in stating the position of the Society and its aims, and for his good wish that the Society might have a prosperous career of usefulness. The objects the Society had in view, and which would be strictly pursued by the Council, with the concurrence and assistance of the members, were good and desirable objects in every sense of the word. These objects might be briefly summarized as: Public benefit in the direction of sanitation, efficiency, and economy. As an example of this, they pointed to their organized efforts to abate smoke pollution—a subject which had been ably handled by their friend Mr. Brackenbury that day, and with which the Society would continue to deal in the future. The second object was the promotion of the interests of the members of the Society in every just and reasonable way, while observing honourable practice in the conduct of business. And, third, their periodical meeting together to discuss all these objects, and to encourage the

spirit of good fellowship. These were worthy aims which could not be gainsaid; and they would strive towards their accomplishment. Much of the success of the Society depended upon a wise Executive, bent on reconciling conflicting interests, and neither showing weak hesitancy nor reckless aggressiveness. Their prospects were certainly of the brightest. They had proved once more the truth of the old adage that "In union there is strength." This was as true to-day as it was when first uttered by Æsop, 600 years before the Christian era. And while the Society recognized the truth of the proverb, they had been able to prove the falsity of that other—"Two of a trade can ne'er agree." They had shown that they could not only agree, but that they could fraternize, and meet together to mutual advantage and for mutual enjoyment. In conclusion, he expressed the pleasure they all felt in having Commander Caborne as a guest on this occasion, and to have listened to, and enjoyed, his genial remarks, for which they heartily thanked him.

Mr. HUGH F. WRIGHT proposed the "Institution of Gas Engineers and Kindred Associations." He spoke of the great value of co-operation between the different organizations in the gas industry in the cause of progress; coupling with the toast the name of Mr. Helps, the President of the Institution, and of Mr. James Paterson, the President of the Southern District Association.

Mr. HELPS, in his acknowledgment, also spoke largely on the subject of co-operation. The President had said that "in Union is strength." Union could be either by combination or co-operation; and by co-operation some good work had been done between the Society of British Gas Industries and the Institution in the matter of the model contract clauses and in other ways. It was also hoped there would be a successful issue to their joint efforts in connection with architects and the building of houses; so that gas stoves and fires might have a better chance than they had at present. There were many other subjects they could discuss with mutual benefit and for the benefit of the gas industry. He believed that, in such matters as those with which they had to deal, co-operation was almost preferable to combination. There could be co-operation in research work; and in this connection he was glad to see the steps that were being taken to ensure that, in the manufacturing of gas appliances, the work was performed scientifically. He hoped that some of the industry's manufacturing firms would, in this way, be able to find employment for young men trained at the Leeds University.

Mr. JAMES PATERSON also responded. Among his remarks he said he felt particularly that there was a strong bond of union between the District Associations and the Society. This bond, though perhaps invisible, was not any less insoluble, because everything the members did to effect improvements must affect in a strong way the work of the gas supply undertakings. Referring to the model contract clauses, he said that any engineer who had read them through must have been struck by the minute care and completeness with which the clauses had been modelled. He felt sure it would be the desire of one and all engineers to embody the clauses in the contracts it was their privilege to arrange, on behalf of their undertakings.

Mr. F. W. WEST proposed the toast of the "Visitors," coupling with it the names of Mr. D. Milne Watson, the General Manager of the Gaslight and Coke Company, and Mr. H. A. Carpenter, of Pittsburgh, U.S.A.

Mr. MILNE WATSON, in reply, referring to the work manufacturers are doing to advance the common industry, mentioned that, fortunately for the gas industry, the winter had set in early and severely; and there had been experienced a large boom in gas-heating apparatus. This boom was causing his Company no little anxiety in keeping pace with the demand; and he was told there were manufacturers working night and day in order to supply the demand for goods. One of the most interesting things about this boom was that it was not all due to the cold north-east winds, but was also attributable to the quiet persistent efforts of the gas-appliance manufacturers in producing more economical gas-fires. In this respect he considered the gas-supply industry was greatly indebted to the manufacturers.

Mr. H. A. CARPENTER thanked the members for their kind reception of him; and from what he had seen that day, there was, he thought, every reason for the formation of a Society of American Gas Industries. It had been a great privilege to him to meet their President, Mr. Thomas Newbigging. In his (Mr. Carpenter's) earliest experiences in connection with the gas industry, he made the acquaintance of "Newbigging's Handbook." He had listened with great pleasure to Mr. Newbigging's address that afternoon; but there was one point—that was, the impression the President brought back with him from America as to stoking machinery—that was absolutely wrong. By America he (Mr. Carpenter) meant the United States, and not Canada. In the United States, there was not a single installation of West's stoking machinery that, from the time the first lid was opened to the time the last lid was closed in a draw, would not deal with 50 per cent. more coal than the machines the President described as extraordinary in his address. Had he known Mr. Newbigging was in America, he could have shown him stoking machinery handling 3000 lbs. of coal a minute, and most beautifully distributed in the retorts, with heavy charges.

"The President," proposed by Mr. CHARLES CLARE, was the concluding toast.

Between the speeches, an excellent programme of song and recitation was passed through by well-known London artistes; and, in every respect, the enjoyment of those present, if it did not surpass, certainly equalled all previous similar occasions.

Modern Methods of Artificial Illumination.—The series of Cantor lectures on the "Modern Methods of Artificial Illumination," delivered by Mr. Leon Gaster before the Royal Society of Arts in February and March last, have been published in separate book form. It makes a unique collection of information on illuminating methods—including gas, electricity, oil, petrol, air gas, acetylene, alcohol, &c.—and is liberally illustrated with pictures of the lamps and apparatus referred to in the course of the lectures, as well as with diagrams and curves. The price is two shillings.

LEGAL ASPECTS OF THE SMOKE NUISANCE.

By C. E. BRACKENBURY, Assoc.M.Inst.C.E., Barrister-at-Law.

[Extracts from a Paper read before the Society of British Gas Industries, Tuesday, Nov. 23.]

The subject of the law of this country in regard to nuisance arising from smoke naturally falls into two great divisions—under the common law of the land, and under statutory law.

I.—AT COMMON LAW.

To understand the legal aspects of the matter, it is necessary to consider some general legal propositions and definitions relating to nuisances generally; for, of course, nuisance from coal-smoke is but one of a vast number of various kinds of nuisance. All nuisances must be one of two classes: public or private.

A public nuisance was defined in the Criminal Code (Indictable Offences) Bill, 1879, s. 150, as "An unlawful act or omission to discharge a legal duty which act of omission endangers the lives, safety, health, property, or comfort of the public, or by which the public are obstructed in the exercise or enjoyment of any right common to all Her Majesty's subjects." To be a public nuisance, the act or omission must affect, or tend to affect, a large number of people, or it must interfere with rights which the public might otherwise enjoy. The most common illustrations of this are, perhaps, in connection with obstructions to highways, as in *Reg. v. Longton Gas Company* (1860), 8 Cox C.C. 317, where it was held an indictable misdemeanour for a gas company without parliamentary powers to open up the highway for the purpose of laying gas-mains; or in regard to pollution of water, as in *Attorney-General v. Cockermouth Local Board* (1874, 18 Eq. 172), where, though a nuisance was not established, it was held that a local board was not entitled to discharge sewage into a river so as to deteriorate the water. That case is also of interest as it lays down the rule that where a public body transgresses its powers, it is not necessary to prove that injury to the public will result therefrom.

It may here be noted that where statutory powers are conferred on any body, there is generally a proviso, as, for example, in the Gas-Works Clauses Act, 1847 (10 Vict. c. 15 s. 29) to the effect that "Nothing in this Act contained shall prevent the undertakers from being liable to an indictment for nuisance."

Proceedings to remedy a public nuisance may be either by abatement, when the persons aggrieved take the law into their own hands; by indictment; or by action at the suit of the Attorney-General, as representing the public. In regard to smoke nuisance, of course, the usual procedure is by summary proceedings as provided by the Public Health Acts.

Turning to private nuisances, these may cause damage to property or inconvenience to personal comfort; but in either case there must be some substantial injury or material interference.

Lord Cranworth, when giving judgment in what was practically a dispute between two gas companies in Sheffield (*Attorney-General v. Sheffield Gas Consumers' Company* (1853) 3 De G. M. & G. 304) used these words:—

"All these cases of nuisance or no nuisance arising from particular acts must, from the nature of things, be governed by particular circumstances. If a carriage were to drive up in Belgrave Square, and stand half the day at the door of a house waiting for some person calling there, I do not think that that could be made out to be a nuisance. . . . Suppose, however, the same thing happened in the narrow part of the street that runs from Covent Garden to St. Martin's Lane, I do not know that that would not be a nuisance. Each case must be governed by its particular circumstances. The particular place or object in view must be regarded. I take it that all these questions are of this nature, 'Are you using that which is the subject-matter of inquiry in a reasonable way and according to the uses for which it was intended?'"

Applying, for a moment, this pertinent question to the subject-matter of coal-smoke, it seems clear that the only answer that could be given would be that the ordinary consumption of coal in a domestic fireplace is use "in a reasonable way and according to to the uses for which it was intended."

Upon the same point, as to the importance of the particular circumstances and the particular locality, the judgment of Baron Pollock, in *Bamford v. Turnley* (1862) 31 L.J.C.B. 286, is instructive. He says:

"Most certainly, in my judgment, it cannot be laid down as a legal proposition or doctrine, that anything, which under any circumstances lessens the comfort or endangers the health or safety of a neighbour, must necessarily be an actionable nuisance. That may be a nuisance in Grosvenor Square which would be none in Smithfield Market. That may be a nuisance at midday which may not be a nuisance at midnight. That may be a nuisance which is permanent and continual, which would be no nuisance if temporary or occasional only. . . . In general, a kitchen chimney, suitable to the establishment to which it belonged, could not be deemed a nuisance; but if built in an inconvenient place or manner, on purpose to annoy the neighbours, it might, I think, very properly be treated as one. The compromises that belong to social life, and upon which the peace and comfort of it mainly depend, will furnish an indefinite number of examples, in which some apparent natural right is invaded, or some enjoyment abridged, to provide for the more general convenience or necessities of the whole community."

Here, again, it may be observed that the usual emission of coal-smoke will be covered by this phraseology, and, though undoubtedly invading some apparent natural right, as of breathing

pure air, yet will fall within the compromises of social life for the general convenience of the whole community.

There is a maxim of the law, *Sic utere tuo ut alienum non lædas*—Use your own rights so that you hurt not another's—which was considered in a case of alleged nuisance from smoke, *Rich v. Basterfield* (1847) 4 C.B. Rep. 783. This is an interesting case for two or three reasons, among which is the fact that, though I have looked at a large number of authorities, it is the only instance I have come across of an action arising out of the smoke from an ordinary house chimney belonging to a defendant as distinct from a factory chimney. The plaintiff lived in St. Pancras, and the defendant owned and let two houses adjoining the plaintiff's. The plaintiff alleged that "the defendant, well knowing the premises, but contriving and intending to injure, prejudice, and agrieve the plaintiff, and to incommode and annoy him and his family . . . wrongfully and injuriously erected a shop and building and two chimneys . . . near to the dwelling house of the plaintiff . . . and . . . lighted divers fires in the said shop and building, and caused divers large quantities of noxious, dirty, offensive, and unwholesome smoke, vapours, and stenches to arise and ascend and issue from and out of the said chimneys; and that the said smoke, &c., . . . spread over and through the said . . . dwelling house . . . and . . . rendered [it] uncomfortable, unhealthy, and unwholesome and unfit for habitation; and the plaintiff had . . . been forced to keep the windows . . . closed for long, unreasonable, and inconvenient spaces of time, . . . and was prevented from obtaining and receiving fresh air . . . and the furniture and chattels of the plaintiff . . . were . . . dirted, spoiled and damaged. . . ." Defendant contended (1) that the act of lighting the fires which caused the smoke was the act of the tenant; (2) that the premises were in the possession of the tenant; and (3) that "every man has a right to the use of the atmosphere for the purpose of carrying off smoke proceeding from an ordinary chimney, with the use of the ordinary fuel." A former occupier stated that he used to make fires in the stove, principally of coke, and that no smoke which could be at all injurious then issued from the chimney. Justice Erle told the jury "that every man is bound so to use his property as not to injure his neighbour's rights—with this qualification, that he may make a reasonable use of his own rights, exercising them in a reasonable place." The jury awarded the plaintiff 40s. damages; but, on appeal, the verdict was entered for the defendant on the ground that the defendant had caused no nuisance and had not possession of the premises. The case of *Rich v. Basterfield* may, therefore, be taken as an authority for the statement that the owner of premises is not liable (apart from statute) for smoke from a stove or chimney becoming a nuisance by reason of improper user by a tenant.

The legal maxim that we are considering is, however, subject to qualification by another—*Lex non favet votis delicatorum*—The law does not favour the wishes of the fastidious. Thus in a case of nuisance from brick-burning at Surbiton, Surrey (*Walter v. Selfe* (1851) 20 L. J. Ch. 433; 4 De G. & Sm. 322), Vice-Chancellor Knight-Bruce said:

> Ought this inconvenience [of smoke, vapour, and floating substances of some kind] to be considered in fact as more than fanciful, more than one of mere delicacy or fastidiousness, or as an inconvenience materially interfering with the ordinary comfort physically of human existence, not merely according to elegant or dainty modes and habits of living, but according to plain, sober, simple notions among English people.

The case is also an authority for saying there must be "substantial inconvenience and material discomfort" before there can be a common-law nuisance. There must be something more than mere loss of amenity.

Upon similar grounds, those who live in towns and cities must (as far as the law is concerned) put up with town and city smoke and discomforts. Lord Cranworth (Lord Chancellor), in *Clark v. Clark* (1865) 1 Ch. App. 16, said: "Persons who live in towns, and more especially in large cities, cannot expect to enjoy the same unobstructed volumes of light and air as fall to the lot of those who live in the country." Similar terms were used by Lord Westbury, L.C., in *St. Helens Smelting Company v. Tipping* (1865) 11 H.L.C. 642. "If," he said, "a man lives in a town, it is necessary that he should subject himself to the consequences of those operations of trade which may be carried on in his immediate locality, and which are actually necessary for trade and commerce, and also for the enjoyment of property, and for the benefit of the inhabitants of the town and of the public at large." But the same case is also an authority for saying, that if there be a nuisance, it is no defence to an action to say that the plaintiff himself came to the nuisance.

It has been held that smoke by itself may constitute a nuisance. In giving judgment in *Crump v. Lambert* (1867) 3 Eq. 409, which was a case against iron bedstead manufacturers at Walsall for an injunction to restrain them from sending out a large quantity of smoke from their factory chimney, and from making a noise, Lord Romilly (Master of the Rolls) said:

> I consider it to be established by numerous decisions that smoke, unaccompanied with noise or noxious vapour, that noise alone, that offensive vapours alone, although not injurious to health, may severally constitute a nuisance to the owner of adjoining or neighbouring property. . . . The real question in all the cases is the question of fact, viz., whether the annoyance is such as materially to interfere with the ordinary comfort of human existence.

An interesting point arises as to whether the combined smoke from a number of different chimneys belonging to different persons might, in certain circumstances, constitute a nuisance, although the smoke from each chimney separately could not be so regarded. It would appear that conceivably there might be such a case in which an action might lie. "Suppose one person leaves a wheelbarrow standing on a way, that may cause no appreciable inconvenience, but if a hundred do so, that may cause a serious inconvenience, which a person entitled to the use of the way has a right to prevent; and it is no defence to any one person among the hundred to say that what he does causes of itself no damage to the complainant."

This dictum was approved of and followed in the two cases of *Lambton v. Mellish* and *Lambton v. Cox*, reported in (1894) 3 Ch. 163. There the nuisance complained of was "maddening" noise, jointly and severally produced by the merry-go-round organs of the two defendants who were rival amusement caterers at Ashtead. Justice Chitty held that "If the acts of two persons, each being aware of what the other is doing, amount in the aggregate to what is an actionable wrong, each is amenable to the remedy against the aggregate cause of complaint;" and an interim injunction was granted restraining each in respect of his own share of noise. Two rights may, therefore, apparently in law make a wrong; and might it not be that two or more ordinary smoke producers might cause together a legal nuisance for which an action would lie?

The remedies for a private nuisance are either by abatement (without process of law), or by action for damages, or for an injunction, or for both.

II.—Under Statute.

Having now considered the aspects of smoke nuisance at common law, let us for a moment look at the statutory enactments relating to the subject.

The first statute in respect of public nuisances was passed in the year 1388, 12 Rich. II., c. 13. It was for "the punishment of them which cause corruption near a city or great town to corrupt the air." We are here to-day in a great city, over 500 years later, inquiring how we can remedy or prevent the corruption of the air. It was not, of course, till the Victorian era, with its vast industrial development and rapid growth of dense population, that General Sanitary Acts appeared on the statute book. In 1833 was the Lighting and Watching Act. In 1847 came the Towns Improvement Clauses Act, the Water-Works Clauses Act, and the Gas-Works Clauses Act, supplying model clauses that could be adopted into Local Acts. In 1848 was the first Public Health Act, the basis of all subsequent sanitary legislation. Then followed the Nuisances Removal Act of 1855, and the Sanitary Act of 1866. Scotland had its Public Health Act in 1867, and England, excluding London, the Public Health Act, 1875 (38 & 39 Vict., c. 55), which superseded and consolidated previous enactments, and still remains in force as the principal Act. I do not propose to deal in any detail with its sections relating to nuisances, among which is smoke. Section 91 is the really important one defining nuisances, included in which is "any chimney (not being the chimney of a private dwelling-house) sending forth black smoke in such quantity as to be a nuisance." In the second proviso to this section a factory fireplace or furnace is hedged round with legal safeguards so as to prevent its smoke being regarded as a nuisance, and the domestic chimney is entirely excluded from the Act.

The summary remedies provided by the Act are, by section 111, in addition to any rights or remedies already existing or available at law or in equity.

The corresponding Act which governs the Metropolis is the Public Health (London) Act, 1891 (54 & 55 Vict., c. 76). Its provisions are slightly more extensive than those of section 91 of the Public Health Act, 1875, and its penalties made cumulative. A dwelling-house chimney is again excluded from the scope of the Act; and in *M'Nair v. Baker* (1904), 1 K. B. 208, it was held that premises formerly used as a private dwelling-house, but at the time of the nuisance as a club, were not exempted by the Act.

III.—General Observations.

What, then, is the net result of our survey of the legal aspects of smoke nuisance? I am afraid it is of a rather negative character. As regards factory chimney smoke, the statutory law provides certain checks in a halting kind of way, and penalties not too easily or strongly enforced. As regards house chimney smoke, the statutory law leaves it severely alone, and the common law does not recognize its ordinary production as a nuisance. With such a statement my duty in connection with the subject-matter of this paper is really completed; but I feel constrained, at the risk of travelling a little outside my allotted sphere, to venture on a few observations with a view of seeing or suggesting what remedial steps might be taken to tackle or mitigate the actual, if not the legal, smoke nuisance.

To look to the legislature as a means of initiating any effective reform in this respect may, I think, be regarded as doubtful, not to say hopeless. If the present Public Health Acts were amended, so as to bring within their scope the smoke from private dwelling-houses, little or no good would, in my opinion, result; for it can hardly be alleged that a chimney of a private dwelling-house frequently, if at all, sends forth "black smoke in such quantity as to be a nuisance." There was, I believe, a Public Health Bill introduced in the parliamentary session of 1906; but it was not proceeded with, and I do not think it contained any reference to

smoke nuisance. This may be taken to show that, in the view of the governmental authorities, the troubles arising from coal-smoke are not such as to call for immediate or urgent legislative enactment. Legislation cannot proceed much in advance of general public opinion. And upon this question of smoke nuisance it cannot be denied that there is a dead-weight of public indifference and inactivity. The problem, therefore, is how to stir up or remove this heavy lethargy of the public. I am not sure, however, that one way of doing this successfully would not be by the legislative imposition of a tax, on the lines of the chimney-money or hearth-money of Charles II.'s reign (14 Car. II. c. 2), on every chimney used for carrying off visible smoke from houses above a certain annual rental; and I make a present of the suggestion to next year's Chancellor of the Exchequer, whoever he may be.

First of all, we have to ascertain exactly and scientifically what is the actual position and what are the real effects of the emission of coal-smoke. Next, to have our minds clear as to what we actually want done; then to ascertain correctly and advisedly how it is to be done; and finally, to get it done.

Facts and figures—concrete, precise, specific—as to the causes and effects of the pollution of the air are essential and imperative. How many house chimneys are there, and how many factory chimneys? What is the average volume of smoke discharged per day, per week, per year, from each class of chimney? What share of blame is to be attributed to each class? What are the average constituents of each kind of smoke? In what proportion are they noxious or harmless? To what extent do they interfere with light, air, health, and wealth? How do they affect vegetable life and human life? To answer such questions as these I should like to see a census taken of chimneys. We have a census of trade production; let us have, also, a census of smoke production. Let our medical officers of health, chemists, and sanitary officials tabulate the results of their experience, and make investigations. If needs be, let chemical officers of health be appointed, and prepare analyses of air to ascertain its degree of purity or pollution. If every town had properly qualified sanitary officials to do systematically such work as has been so admirably done by Professor J. B. Cohen and Mr. A. G. Ruston at Leeds (and recorded in a paper before the Health Congress in July*) there would soon be such an array of indisputable facts and unimpeachable figures that public opinion might be roused, and some ameliorative action ensue. Such statistics would provide ammunition for a campaign; at present there is nothing but vague generalities.

The relationship of smoke and disease might be enquired into, and vital statistics obtained. All that one has now is some kind of intuitive feeling that smoke means dirt, dirt means disease, and disease means death.

I believe that in the educational curriculum of our State schools there is included the subject of hygiene; and the uses and abuses of tobacco and alcohol are taught and explained. It would not seem unreasonable to include in such lessons, or in the housekeeping classes, instruction in the benefits of smokeless or gaseous fuel. The coming generation would reap the advantage.

I do not shut my eyes to the fact that the question of the presence or absence of coal-smoke is fundamentally one of cost. It is idle, in my view, to ignore this, or to endeavour to gloss over it by enlarging on the convenience and the cleanliness of the gas-fire—except, of course, in particular circumstances and for trade purposes. If we seek deliverance from the smoke nuisance of coal fires (assuming for the moment that the domestic coal grate is, at least, partly responsible for it), we must face the fact that it is a question of economics. It is but nibbling at the problem to put a few gas-fires into the houses of the well-to-do. If the domestic smoke from the small house or the poor man's room is the culprit, the nuisance will only be in measurable distance of being removed when something cheaper and better is offered in place of coal. And I suppose it is, to some extent at all events, more within the power of gentlemen in this room, and of the Institutions and Societies that they represent, to find that "something" than it is within the power of any body of gentlemen elsewhere.

I take it that all are theoretically in favour of the abolition of coal-smoke and of the nuisances accompanying it; and it only remains to convert the theory into practice, and energetically, aggressively, and practically to combat the evil. To do this efficiently requires the whole-hearted and enthusiastic collaboration of many men and many interests and many Societies, among which prominent places must be taken by your own Society of British Gas Industries, the Institution of Gas Engineers, and kindred technical Associations. The Coal Smoke Abatement Society, under the presidency of Sir Wm. B. Richmond, K.C.B., R.A., has long directed attention to the matter. Artists, architects, chemists, engineers, manufacturers, medical men, scientists, and last, but not least, the man in the street, as well as the woman in the house, are all interested and concerned in the question. It is the day of Garden Cities, of a longing for land, of a leaning to the country—all symptoms, if I mistake not, of a reaction against the dirt and noise and crowding of our urban centres. Let us turn this desire for cleanliness and for fresh air to account, and though the task be great, do what in us lies to leave behind us a brighter, cleaner, healthier, and happier community.

Discussion.

The PRESIDENT (Mr. Thomas Newbigging) thought the members must all agree that the paper to which they had listened was one of an excellent character. It would be good for reference for years to come, not only by the members, but by others interested in the question elsewhere. He was pleased to see the President of the Institution of Gas Engineers present; and he would ask him to open the discussion.

Mr. JAMES W. HELPS (Croydon) was glad to have an opportunity of saying a few words on this important question; but, before doing so, he should like to congratulate Mr. Brackenbury upon the excellence of the paper, and the food he had given them for future thought. He could not help asking himself when he heard a paper of this kind, why it was that they, as gas engineers, and those engaged in the manufacturing and commercial work of the industry, were acting somewhat the part of philanthropists. They naturally had a great desire to see the towns in which they lived freed from fog and smoke; but they, as it were, were really doing far more than had been done by those who had these desires quite as much at heart as, if not more than, they themselves had. He could only answer his own question by saying that it was because the gas industry had something to sell, by means of which, and by the appliances by which it was used, they hoped eventually to bring about the desired result. There was no use whatever disguising the fact that it was because they were makers of gas and of a good solid smokeless fuel, and also manufacturers of the apparatus and appliances which were best calculated to use gas and coke, that they were doing their best in this matter. It seemed to him that was naturally the attitude they were compelled to assume on this question. And they had to direct attention to two particular points, if they wanted to see any good arise. First of all, it was absolutely necessary that they should devote even more attention than they had done in the past to prove to the general public that the use of gas-stoves was not deleterious to health. He was quite aware that a great effort was being made at the present time in this direction—partly at the Leeds University, and partly, he was glad to see, in the laboratories of those broad-minded manufacturers who had taken up the subject from a scientific point of view. A great deal more, however, remained to be done before they would get rid of the erroneous idea which was prevalent in many towns. In his own town, one might hear sometimes of a doctor who the first time he was called in to see a patient would say something to this effect, "Turn out that gas-fire; if you do not, I shall not come here at all." This had not been said to him personally; but he had it from other people that it was said. They must not be satisfied, therefore, until they could get such information to lay before medical men as would prove to them that a gas-fire was quite as hygienic as a coal-fire. He was sure much good was being done by directing attention very seriously to the abolition of the smoke nuisance. Another point to which they must pay careful attention was this: It was no good advocating that a fuel should be used continuously and regularly, unless they were prepared to say that it could be supplied at something near the same price as the one it was going to displace. It was not any good saying, and he did not think anybody would attempt to say, that a room could be warmed for an extended period at the same price by means of a gas-fire as by a coal fire. He (Mr. Helps) could not honestly say so. Therefore, it was their bounden duty to do all they could, by every means in their power, to supply gas at as cheap a rate as they possibly could. He did not know that there was anything he could suggest which would help to cheapen gas for this particular purpose. It was true that one could perhaps suggest that larger discounts should be allowed for gas consumed for heating than for lighting and other purposes. But, again, there was no use denying the fact that in winter, when gas was used for heating purposes, gas was produced at the highest cost. Every extra foot of gas they made for use in gas-fires during the dark hours of winter cost so much more in its equivalent in retorts, mains, and everything else, and so put the cost at a higher figure. The same contention did not apply in regard to cooking; and it was in the direction of doing away with the coal range in summer for cooking that he particularly felt inclined to direct his energies, because he thought it was a good thing not only in respect of the abolition of the smoke nuisance, but for the manufacturers of gas cooking-stoves and for those who sold gas for this purpose in the day and the summer time. However, in respect of the subject in hand, they must bear in mind that they were taking up the smoke nuisance question principally on account of the sale of their commodities; and that it was their bounden duty therefore to do all they possibly could do to prove that gas was firstly, hygienic, and, secondly, that it was cheap.

Dr. BRACKENBURY (brother of the author) said he had no connection with the gas industry, other than his relationship with the author; but he thought he might say in connection with the paper that he stood there in three capacities. In the first place, he was a medical man; and the last speaker had referred to the relationship between medical men and the gas industry in terms that were quite reasonable. In the second place, he was a member of a public health authority. And, in the last place, he was chairman of an educational authority. There was one statement in the paper that required qualification. The author had spoken about the inactivity of the public health authorities. This was undoubtedly true with regard to the smoke produced by ordinary house fires; but he could not say it was true in regard to the smoke produced by chimneys of other descriptions. When he came up for election, as he had to do in this public authority every three years, to say nothing of the times in between, he received as much complaint from the public with regard to the smoke nuisance as he did in connection with any other kind of nuisance or inconvenience.

* See p. 613.

But the public had to put up with some of these things; for it was really difficult to know how to deal with certain of them, which were really nuisances. Nor did he know, after hearing this paper, how to deal with some of the cases that came before them. He gave an instance of a railway engine-shed; explaining the circumstances in connection with it. Passing on, he said, as a medical man, he could say that it was becoming increasingly recognized by the medical profession that there was no harm, from any point of view, in a gas-fire. He had himself recommended that patients should have coal fires taken out of their bed-rooms, and gas-fires put in, because there were certain advantages which were not disadvantages from a sanitary point of view. Another medical aspect of the matter had been pointed out by the last speaker, in referring to the gas industry as philanthropists. There was no doubt the gas industry was such in respect of the purification of the atmosphere. But there was another side to that. He had a patient who came to London every winter because he could breathe better there than elsewhere. [Laughter.] And it was true there were some people suffering from real asthma who could breathe better in a thick atmosphere than in any other. It was quite possible there were such people in the neighbourhood of chimneys which were producing smoke that was a nuisance to others, but who might be absolutely better for its presence; and if remedial measures were taken to stop the nuisance, these people might start some legal action in the matter. [Laughter.] It had been suggested in the paper that notice might be taken of this matter of smoke prevention and the use of smokeless fuels in our public elementary schools. To a certain extent this was being done. The teaching of hygiene in schools had become very generally recognized; and in almost the first syllabus that he drew up for this purpose, he introduced the question of the proper heating and ventilation of small rooms. In their own schools and other schools, this subject was not neglected; and he believed it was capable of further development. There was not the slightest reason why in elementary schools the children should not be taught the value of smokeless fuels.

Mr. Lawrence W. Chubb (Secretary of the Coal Smoke Abatement Society) remarked that it seemed to him, after listening to Mr. Brackenbury's paper, that there was one point which they ought to consider; and it was as to whether the law as expounded by him was at the present time in the satisfactory state in which an intelligent community would expect to find it. Was the law as expounded equal to performing all that it ought to perform? In theory, he thought Mr. Brackenbury had shown that it was; in practice, those of them who were concerned to some extent in the administration of the law were bound to confess that, for one reason or another, in many cases at least, the law was a dead-letter. They had in London authorities who were a standing pattern to the whole country in regard to the administration of the law with regard to this nuisance. Headed by the London County Council, with the help of the City Corporation and the Borough Councils, they had a series of most vigorous local authorities who did look, and look efficiently, after the interests of the community all round London. But there was a ring of authorities who, on the whole, absolutely ignored their responsibilities to the public in this important matter. The reason might not be far to seek. In the smaller municipalities, as a rule, they found, unhappily, that the smoke makers were very well represented. It was not, therefore, to be expected that the sanitary officers who were charged with the duty of reporting upon the smoke nuisance would not hesitate to report nuisance which might have arisen in respect of the premises of members of their own Public Health Committee; and until the law put the sanitary officer on a proper footing, and gave him protection (which one was glad to see was accorded to the medical officers of health) against being discharged at the whim of the Public Health Committee, and establishing him in office until the Local Government Board said he must go, this condition of things would not be rectified. It was a disgrace to us as a community to see West Ham and other municipalities pouring out their black smoke in the air. Whereas in London they were forced to comply with the law, the people in the outer ring were allowed to throw into London masses of smoke, which went to form the November fogs, and to do so with impunity. The law was not particularly easy to administer, in the experience of many authorities, for one very simple reason—that it was the emission of "black" smoke that constituted a nuisance. They knew that "black" was a relative term, and what to one man might appear black might be looked upon from quite the opposite aspect by another. The smoke might be pungent, and it might form a perfect canopy over one's head; but unless they could convince a magistrate by the evidence of inspectors that the smoke was black, they would not succeed in getting a conviction. This seemed one of those instances which showed that the law was either the proverbial ass, or that it required amendment. He was glad to see the London County Council had begun to deal with this particular matter so far as the Metropolis was concerned, and that municipalities, such as Nottingham, where it was important in view of the industries of the town that there should be a clean atmosphere, had obtained special powers from Parliament enabling them to put down the emission of smoke as soon as the smoke was sufficiently dense to constitute a nuisance. The following day the "London Gazette" would contain a notice that the London County Council intended to apply to Parliament in the next session for authority to amend the Public Health Act of London by deleting the little word "black." If this proposal became law, they would be capable of dealing with the matter, providing it was possible to prove that the smoke was a nuisance. There was, however, a popular impression that, if they put down the smoke nuisance, they were persecuting the manufacturers. The evidence that the Smoke Abatement Society had from some of the most brilliant engineers of the day went to prove conclusively that the nuisance could be abated to the profit of the manufacturers. Messrs. Crossfields had publicly stated that by adopting proper machinery for the consumption of coal, they saved over £25,000 a year in their coal bill. The Chairman of a well-known London brewery quite recently stated that they saved over £3500 by consulting an engineer in this matter, and adopting the most simple inventions. If they could only make their local authorities realize that, when trying to abate the nuisance from a manufactory, they were not pressing hardly upon the manufacturers, but conferring a benefit upon them, they would succeed in doing something really good. Mr. Brackenbury suggested in his paper that the question of the adoption of gas-fires and smokeless methods of heating was entirely one of cost. He (Mr. Chubb) thought if they coupled with cost prejudice, the statement would be perhaps a little more accurate. Why people should have a rooted aversion to putting in comfortable methods of heating, the Smoke Abatement Society had never been able to determine. A year or two ago, at the request of the Office of Works, and with the active assistance of that office, the Society conducted a series of tests, aided by the Gaslight and Coke Company, of a number of the best gas-stoves. The tests were most elaborate; and they attracted considerable attention. The trials proved that gas-fires, if properly fixed and looked after, were most effective methods of heating. The air of the room did not in any way confirm that the health of the inhabitants of rooms in which gas-fires were would in any way suffer; but that the fires could be adopted by all and sundry without fear of the consequences. The Society had in this way done their utmost to increase the use of gas. They recognized that in gas they had one method, and one of the most important methods, of removing the abuse which had existed in the past, and to remove also that stigma under which the Metropolis suffered. So far as the gas industry contributed, by the adoption of gas cookers and fires, to the amount of sunshine that the inhabitants of London and other large cities and towns received, he said with all sincerity on behalf of the Smoke Abatement Society "more power to your elbow."

Mr. R. H. Clayton (Chairman of the Manchester Section of the Society of Chemical Industry) said he had turned his attention to the analyzing of the constituents of town smoke, and comparing it with factory smoke, hoping thereby to obtain some idea as to the relative proportion of impurities in the air through domestic fires and through factory fires. He had been much struck, even in large towns, where the factory smoke was well washed, and was not visible to any great extent, by the fact that the atmosphere did not show any very great improvement. He had therefore come to the conclusion that domestic fires were much greater causes of the smoke nuisance in London than factory fires, and that, if factory fires in London were to be abolished altogether, he did not think that the atmosphere would be much better. He agreed with Mr. Brackenbury's statement that they could not advance legislation before public opinion. He took it it was the view of those present that public opinion should be forced forward, not as in the past by legislation and police court methods, but rather that they should investigate the causes of the pollution of the atmosphere, and ascribe the right proportion of nuisance to each evil-doer. It was only by the application of the higher scientific methods, by the analysis of the air, by comparison of analyses from different towns, by putting the matter in the hands of investigators and inspectors of the type of the Alkali Works Inspectors, that they could really hope to push forward this matter. The purification of air was, in his opinion, a question for the communities and local authorities to take up just as much as the purification of sewage. There was a point as to the cost of gas. It had been stated that the cost could not be much reduced; but it occurred to him in thinking over the point, that there was a way if the use of bituminous coals was prohibited in ordinary fire-places. The fuels left would be gas and coke. Coke was a finished product, and not a raw material; and, doubling the price of coke would only bring it to the same price as coal, roughly. The difference derived from this would bring the cost of gas to about 6d. per 1000 cubic feet. In other words, the price of coke should be pushed up; and the price of gas down. That was a question which had not yet received the attention it deserved. Of course, it was subject to the prohibition of the use of bituminous coal. He wanted to more particularly put forward the point as to the analyses of town air showing an enormous amount of tar oils, which were produced from domestic fires by slow distillation. In domestic fires the coal burned or distilled would produce 5 per cent. of its weight as tar oils and soot. He calculated that the 6 million tons of coal used in a year in London gave 300,000 tons of soot and tar oils per annum. This was the problem facing them; and the point must make itself sufficiently apparent, that this amount of soot and tar oils going into the London air must make itself felt. He quoted analyses made by himself to show that air pollution in Manchester was due more to domestic than to factory smoke.

Mr. Thomas G. Marsh (Manchester) related how the previous Friday he was passing the Manchester Town Hall, and saw smoke coming from all the offices round about; and there was a great column of smoke coming from the Town Hall. He went in, and called the attention of the Superintendent of the Nuisances

Department to it. The Smoke Abatement Inspector of Manchester had informed him that Manchester air was practically free from factory smoke; the manufacturers having too great an eye for economy to allow any considerable amount of smoke being emitted. The people he should like to get at first, and the people who ought to show the way, were the municipal leaders; and it was in the hands of each and every one of those present to do a part in converting the public. In Manchester, the district rates were reduced by 1d. in the pound with money seized from the gas profits; and the personal expenditure of the citizens was increased by something like 3d. or 4d. in the pound in the decoration of their buildings, in cleaning them, in laundry work, and in supporting hospitals for consumption and other diseases caused by air pollution. He considered the Corporation ought to sell gas for such purposes as would tend to the cleanliness of the atmosphere at very little above cost price. They could afford to do so, and would gain through the reduced expenditure of their Committees. He would never be converted to the advantages of municipal trading so long as he saw the profits taken from one Committee simply for the purpose of bolstering up others. The great thing was to make the general public fully alive to what was going on. Their President had inadvertently referred to the Society for the Abolition of the Smoke Nuisance. He (Mr. Marsh) should like to see the word "abolition" take the place of "abatement," because there was no necessity whatever for smoke. They could get heat without smoke, and they could get power without smoke. Mr. Clayton had put the matter forcibly when he referred to the money spent on purifying sewage before passing it into the rivers. It would make the hair of municipal councillors stand on end if it were said that the water the people were drinking was impure; yet though each individual breathed in many more volumes of air every day than he drank water, they heard nothing about the impurity of the air. He had received a letter from Dr. Brown, the Medical Officer for Bacup, who thought very strongly upon the action of municipal authorities round about Manchester. He pointed out that the death-rate was made higher by the smoke and other impurities prevailing; and he asked why gas could not be sold by municipalities at 10d. or 1s. per 1000 cubic feet. He (Mr. Marsh) believed that the reason some doctors objected to gas was because there was not sufficient draught caused by the fires; and this was due to gas being dear, and consequently there was economy in the quantity burned. In his letter, Dr. Brown also suggested that at an early date a conference on this subject should be held, of members of the sanitary societies, medical officers of health, the Smoke Abatement Society, and practical engineers and chemists. From such a conference might come the solution of one of the greatest problems and difficulties of the country to-day.

Mr. SAMUEL GLOVER (St. Helens) said he thought it would be a mistake for the Society of British Gas Industries and representatives of the gas-supply industry present, in the presence of the Coal Smoke Abatement Society's representatives, to sound nothing but a deploring note year after year. Surely something was being done; and if they summed up the continual pegging-away that was going on, he thought some credit would be given to those working in the gas industry. The result of their pegging-away was that the deplorable state was either not so bad as it used to be or not so bad as it would have been if nothing had been done. It was within his knowledge that a great deal was being done not only in the way of reducing domestic or town chimney smoke other than manufacturing smoke, but a great deal was being accomplished in reducing the smoke of works' chimneys, inasmuch as it had been found economical to attack the smoke abatement nuisance from works' chimneys by the adoption more and more of internal combustion engines. This had been done very largely indeed in many towns, and even in small towns. He thought corporations and companies supplying gas should have credit for the large reduction in the output of objectionable smoke that had been made by the use of gas-engines, large and small. They were also much encouraged by the knowledge that every month thousands of gas-fires were going into use; and if the community did not already do so, it was high time they did appreciate the fact; also that steps had been taken to deliver to householders smokeless fuel in the form of prepared gas coke; and, further, that great improvements had been made in the production of gas-fires. A great deal of good was being accomplished; and if this was the only practical way of doing it, something was year by year being achieved, and was at last reducing the difficulty that they had all observed.

The PRESIDENT said it seemed to him to be an almost hopeless task to deal in some drastic way with the production of chimney smoke. There was nothing for it, it appeared to him, but to keep pegging-away to show the community how much better it would be if they would use something else than coal as fuel. He did not say gas. It might be anything else in order to get rid of this fearfully deleterious nuisance. But he did not think there would ever be any legal enactment to compel people not to use coal. In the reign of Elizabeth there was an Act passed preventing people using what was called sea-coal for their domestic fires. They could hardly pass such a measure to-day. So there was nothing for it but to keep pegging-away, and showing people there was something—possibly some economy—in giving up their bad habits. But it was an awful job to eradicate bad habits. The discussion would be very useful to them, in their several spheres throughout the country, in the promulgation of this great sanitary question.

SPREAD OF LONG-DISTANCE GAS SUPPLY ON THE CONTINENT.

Some particulars have been given from time to time in the "JOURNAL" [see Vol. CIII., p. 507] of the numerous installations of high-pressure mains, for the supply of villages at a considerable distance from the gas-works, which have been laid down in recent years in Germany and adjacent countries. A communication on the subject was presented by Herr Menzel, of Berlin, to this year's meeting of the Brandenburg Association of Gas and Water Engineers; and as it reviews the development of this branch of gas supply in a very comprehensive manner, particulars may be quoted from a reprint of the communication which appeared in a recent number of the "Journal für Gasbeleuchtung."

After referring to the comparatively small number of installations for the supply of distant communities which were at work in the year 1905, the author points out that nearly all these have been enlarged or extended, and that a great number of fresh installations have come into being. More than forty gas-works now supply gas to small townships at a considerable distance from the works; and the results of such supply have proved entirely satisfactory. The advantages of a supply of gas for lighting, cooking, and heating purposes are thus brought within reach of the inhabitants of small outlying towns. A tabular statement of the existing high-pressure mains of a length of a mile-and-a-quarter and upwards to 12 miles is given, from which it appears that there are thirty such long-distance supplies working with equalizing gasholders and nine without these special holders. Taking only distances of 5 miles and upwards, the following is a statement of the existing supplies:—

TABLE I.—*Long-Distance Gas Supply Plants.*

Situation of Gas-Works.	Place Supplied.	Length of High-Pressure Main.	Diameter of High-Pressure Main.
		Miles.	Inches.
(*a*) Installations with Equalizing Gasholders.			
Bühl	Steinbach, Sinzheim	6·1	3½
Kiel	Wik	5·0	..
Leyden	Sassenheim	9·1	4
Lichtenberg (Berlin)	Malsdorf	11·5	4
Lübeck	Schlutup	6·2	3½ to 4
Lübeck	Travemünde	12·2	3½ to 4
Meilen	Staefa, Erlenbach	8·8	2¾ to 3½
Mülheim (Ruhr)	Saarn	7·0	..
St. Margarethen	Marbach, Altstetten	10·5	3 to 6
Salò	Maderno	5·6	3½
Schaffhausen	Diessenhofen	5·8	2¾
Schneidemühl	Usch	6·5	..
The Hague	Ryswyk	8·1	8
Thonon	Evian	5·5	..
(*b*) Installations without Equalizing Gasholders.			
Heidelberg	Schlierbach	5·0	..
Mariendorf (Berlin)	Wilmersdorf	5·8	..
Mügeln (near Dresden)	Zuschendorf	13·7	4

The high-pressure system for the supply of gas to a distance has the advantages that the cost of the main is low, owing to the high-pressure admitting of large quantities of gas being pumped through a pipe of comparatively small diameter, and that either by increasing the working pressure, or by extending the time during which the gas is pumped through the main, its working capacity can readily be increased to meet an extension of the local distributing system or an enhanced consumption of gas due to any other cause. It has been found advantageous to wash the gas with oil for the extraction of naphthalene before pumping it into the high-pressure main; and when this has been done, there have been no cases of obstruction of the main by naphthalene deposits. Either Mannesmann tubes or cast-iron pipes have been used, according to the ideas of the engineer of the gas-works concerned; and it cannot be said at the present time that one has any special advantage over the other. The joints are made sound in the ordinary way, with lead and tarred hemp; but in a few places lead wool has been satisfactorily employed in place of run lead.

The working pressures hitherto employed have not necessitated the use of any other joints than these, which have the advantage that they allow of a certain displacement of the main without giving rise to leakage. The pressure of the gas is raised by means of either Roots blowers, fans, or piston pumps; and, generally speaking, all three systems have proved completely satisfactory. Where, however, specially high pressure is required, the piston pumps or compressors are to be preferred. It is essential that some safety appliance which stops the compression when a maximum pressure has been attained, should be inserted in the system. Specially adapted for this purpose is a device of Rabas, which consists of a ratchet and pawl arrangement by which the compressing plant is put out of action when a particular maximum pressure is attained. Thus it is not necessary to exercise great care at the gas-works in maintaining continuous supervision of the compressing plant, as the working is thus rendered more or less automatic. It has been found advantageous to employ gasholders fed either continuously or else at certain times through the high-pressure gas-main. The holders have the advantage of

equalizing the pumping of gas irrespective of fluctuations of consumption. Consequently, the high-pressure main may be of smaller capacity when these holders are used. This reduction in the size of the high-pressure main balances to some extent the cost of the gasholder. Also when a holder is used, the main need not be continuously kept under high pressure.

It has been found valuable in many instances to connect detached houses and works adjacent to the high-pressure main to it. As, however, the pressure in the main fluctuates greatly, special governors have to be employed on these isolated connections. Herr Hase, of Lübeck, devised a special governor for this purpose when some consumers were directly connected to the high-pressure main between the Lübeck Gas-Works and Travemünde. This governor has been in use there for several years, and has proved satisfactory. It consists of a water-chamber in which a bell moves and actuates two taps, which serve as throttles. The bell may be replaced by a parchment or similar diaphragm. It is specially important that two throttles should be used, so that very high pressures may be taken up in two stages; while in the event of one of them becoming temporarily ineffective, the second one prevents the high pressure passing into the consumer's service. District governors are used where the high-pressure mains are directly connected with the low-pressure distributing system. These are usually placed in an underground pit. The pressure is taken on and off by means of weights, and continuous supervision of the governors is not necessary. These district governors may advantageously be connected with a long-distance pressure lamp lighting and extinguishing device. A device is attached to the gasholders by which the inflow of gas to the holder is automatically cut off as soon as the holder is approximately full, and is resumed as soon as a certain amount of gas has been withdrawn from the holder.

The best proof of the successful results which have attended the introduction of the high-pressure system of supplying gas to a distance is afforded by the statistics which the author has collected of the consumption of gas in a number of the communities thus supplied. The installations in the majority of cases have been in existence for only a year or so; and, consequently, it is only in a few instances that particulars are available for a series of years, and that the growth of gas consumption from year to year can be shown. The statistics collected by the author are set out in the original paper in much detail in a series of tables. Table II., which has been prepared from them, gives the more important totals and essential data.

TABLE II.—*Particulars of Output of Gas Through a Number of Long-Distance Supply Plants.*

Gas-Works From Which the Supply Emanates.	Places Supplied; With Their Approximate Population.	High Pressure Main.		Date at Which Supply Started.	Output of Gas for the Years Stated.		Increase in Output Over Preceding Year. Per Cent.	Proportion of Total Output Sold for		
		Length. Yards.	Diam. Inches.		Year.	Cubic Feet.		Lighting. Per Cent.	Cooking. Per Cent.	Public Lighting. Per Cent.
Lichtenberg (Berlin)	Kaulsdorf, &c.— 7,250	20,168	4	June, 1905	1906	8,898,680	—	39·3	22·8	37·9
					1907	13,124,700	47·5	38·8	28·9	32·3
					1908	17,680,800	34·7	35·7	32·1	32·2
Heidelberg	Wieblingen, &c.— 10,400	—	—	Dec., 1907	1908	6,883,910	—	20·6	43·3	36·1
Salmünster	Wächtersbach— 2,400	8,240	3½	Dec., 1907	1908	1,995,390	—	42·6	40·0	17·4
Crefeld	Bockheim, &c.— 17,085	4,648	6	Jan., 1908	1908	14,978,500	—	36·8	45·8	17·4
Schaffhausen	Diessenhofen— 2,000	10,060	2¾	Oct., 1905	1906	2,258,350	—	—	—	—
					1907	2,508,610	11·1	—	—	—
					1908	2,957,450	17·9	—	—	—
The Hague	Ryswyk— 6,000	1,258	8	Feb., 1906	1906	3,119,050	—	—	—	—
					1907	6,055,130	94·2	—	—	—
					1908	8,764,410	44·8	—	—	—
Lübeck	Travemünde, &c.— 7,554	31,715	3½ to 4	Sept., 1903	1904	4,629,650	—	42·7	35·8	21·5
					1905	7,790,160	68·3	43·0	37·8	19·2
					1906	9,555,540	22·1	41·4	39·8	18·8
					1907	12,833,600	25·6	37·2	47·7	15·1
					1908	14,648,500	12·4	38·1	48·0	13·9
Leyden	Voorschoten— 5,072	15,530	4	Oct., 1907	1908	7,160,800	—	84·3		15·7
Differdingen	Rodingen, &c.— 8,552	5,468	2¾	Nov., 1905	1906	3,262,190	—	42·5	34·2	23·3
					1907	4,839,430	48·4	45·2	35·4	19·4
					1908	5,565,540	15·0	44·1	35·2	20·7
St. Margarethen	Marbach, &c.— 38,900	18,590	3 to 6	1903	1906	21,288,100	—	50·4	45 0	4·6
					1907	27,402,500	28·7	39·4	57·0	3·6
					1908	33,754,400	23·2	33·3	63·5	3·2

It is noteworthy that about half of the total quantity of gas supplied through these installations is used for cooking purposes, which indicates that, even in quite small places, there is a demand for gas for cooking. The price is generally regarded as the all-important factor in increasing the sale of gas for cooking. Nevertheless, there is in all cases a steady increase in this branch of the gas consumption. A striking example of the applicability of the long-distance supply of gas is afforded by the installation at Lübeck. One of the places supplied—viz., Travemünde—is a bathing resort, where there is a specially large consumption of gas for cooking, because visitors, coming mostly from large towns, are accustomed to cook with gas.

Of the installations outside Germany, the most interesting is that in the Rhine Valley (St. Margarethen), because it was the first long-distance supply on a large scale and because it has continued to develop in a very striking manner. The general deduction to be drawn from a consideration of the figures relating to long-distance gas supply is that there is a demand for gas in quite small communities, and that the gas industry should exploit these places which have hitherto been exclusively reserved for long-distance supplies of electricity. The management of each gas-works should carefully consider whether in its vicinity there are not places that are suitable for long-distance supplies of gas. Where there are no existing gas-works within easy reach, it is worth while considering whether a number of small places may not combine to erect a gas-works for their common use; the supply being by high-pressure mains, such as those referred to in this article.

At the conclusion of the reading of the foregoing paper, Dr. W. von Oechelhaeuser, the Managing-Director of the German Continental Gas Company, of Dessau, addressed the meeting. He referred first to the use of turbine blowers as described by Herr Pfudel and Herr Pohmer [see "JOURNAL," Vol. CVII., p. 378] in connection with a supply of gas at high pressure. In regard to the opinion expressed, that these blowers constituted an immense advance for the gas industry, he wished to point out that many advances had been similarly claimed in the past for other inventions by which it was anticipated that the gas industry would be placed in a much more favourable position than its rivals. It was only necessary to refer to the expectations raised by the Körting steam jet-exhauster in 1872, the use of compressed air with West's charging and drawing machinery in the beginning of the seventies, the adoption of hydraulic power in the Foulis stoking machinery in 1875, and the driving of dynamos for electric central station work by gas-engines, which was adopted at Dessau in 1886. In the electrical industry likewise, old types of certain plant—*e.g.*, accumulators—have been displaced in turn by others.

It is necessary to mention these points by way of contradicting a widely-spread impression that there have been comparatively few advances in connection with the gas industry. For instance, the Welsbach light is often spoken of in a manner which implies that, prior to its discovery, there had been practically no advances in gas lighting, and particularly in the construction of burners. As a fact, the advances in burner construction were enormous before the introduction of the Welsbach burner. There has been likewise the same continuous advance in the development of retort-settings, from the plain direct-fired setting to that provided with producer firing, and so on through the various types of regenerative settings to the inclined retorts, in the development of which the late Mr. Ed. Drory was specially active. We have passed on now from the inclined retort to the vertical retort. The long distance supply of gas at the present time is only a new form of an old system. When the speaker was in England for the first time in 1877, he saw the long distance main from the gas-works at Beckton to the distributing stations in London; and he believes that it was worked at a pressure of 26 to 28 inches. There is not a very great jump from this pressure to the 50 inches or so which is now being employed in the high-pressure mains for distant supplies. The speaker also referred to a more daring proposition which his own father, at the beginning of the seventies, laid before the City Council of Berlin. It was feared that in the City there would not be sufficient room under the street pavements for the large gas-mains which would be required subsequently for the supply of gas; and the proposal was to connect to the present low-pressure system of mains high-pressure mains

working at a pressure of several atmospheres. This plan was too bold a proposition for the time, and it was believed that the compression of gas to a high pressure was not industrially economical. Nevertheless, the plan has been to a certain extent followed in the modern mains for the supply of gas to long distances; but those who are busily engaged in the gas industry at the present day are too apt to blot out from memory the recollection of what has been done in the past, in their zeal for what is being accomplished at the present time. It is sometimes beneficial to take a backward as well as a forward view of events.

At the conclusion of Dr. von Oechelhaeuser's remarks, Mr. E. Körting, of Berlin, the Chairman of the meeting, expressed the hearty thanks of those present to him, and to Herr Menzel, the reader of the paper, for their valuable communications.

COMMERCIAL USES OF GAS.

Lecture by Mr. S. R. Barrett, of Birmingham.

On Wednesday evening last, an interesting address, on the "Commercial Uses of Gas," was delivered by Mr. Sydney R. Barrett (the Superintendent of the Fittings Department of the Birmingham Corporation gas undertaking) to the members of the Birmingham and District Master Gas-Fitters' Association. The following are some abstracts of the lecture, which was accompanied by diagrams and experiments.

Natural gas is one of the mainstays of the great iron-producing districts in the United States; and we can realize the enormous commercial value of this natural resource, when we know that this gas has continued to flow from the huge natural reservoirs beneath the earth's surface for the past 25 years, at a pressure of 70 or 80 lbs. per square inch, and of a quality 50 per cent. better than that of the best artificially distilled coal gas. Entire towns are lighted and heated by it; while in the reduction of ores, obtaining steam pressures in boilers, and obtaining power direct from gas-engines, the whole appliances of modern American factories adapted to high-pressure gas in the natural-gas districts have become perfected. As the demand for natural gas has increased, it has become necessary to extend the area of supply; and in districts 150 miles from the site of manufactories, fresh wells have been sunk, and the natural gas has been conveyed through long pipe-lines to smelting furnaces and factories. It seems, therefore, that Nature had intended in the first instance that gas should be used by man in a compressed form—in other words, that it should be used directly as high-pressure gas.

It is very interesting to note that, as far back as 1825, Professor Faraday gave a lecture before the Royal Society of London on oil gas, as manufactured from mineral and vegetable oils by the Portable Gas Company of London; and gas as first sold to Londoners for lighting their houses was compressed to 30 atmospheres, or 440 lbs. per square inch, and was sold to them in this form in iron vessels. This Company did not last long; but their iron vessels did, and for years afterwards on the site of the present Roman Catholic Cathedral in Westminster, which had been used as a dumping ground for scrap and refuse of all sorts, these old iron gas-bottles were found by the score. Earlier than this, in 1792, Murdoch compressed coal gas at Handsworth.

Mr. Pemberton, of Birmingham, made a series of experiments on the production of coal gas and its application to lighting, and exhibited gas-lights in a variety of forms in front of his establishment in one of the main streets of the town; and in 1808, he erected an apparatus for Mr. Cook, a toy manufacturer, by whom gas was employed for soldering purposes. From that time, Mr. Pemberton devoted himself to the construction of gas-works. This was in all probability the first occasion that coal gas was used for a manufacturing purpose in Birmingham.

In 1819, Gorden and Heard took out patents for compressing coal gas into a portable receiver, for placing under the seats of carriages or on board ship, in order to obtain light; and in 1845, Brunell compressed coal gas up to 440 lbs. per square inch in iron reservoirs, for lighting railway carriages. This use of gas at high pressure was abandoned in consequence of the cost of compression, and of the necessarily strong receivers, and the difficulty of reducing the pressure to such a point that the gas could be burned regularly and without waste. It was not until Pintsch, of Berlin, in 1873, introduced his high-pressure governor that compressed gas came into general practical use. Since then it has been universally employed for railway carriage lighting, floating beacons at sea, lighthouses, and for many manufacturing purposes. At the present time, ordinary railway carriage lighting utilizes oil gas compressed to 120 lbs. per square inch in cylinders containing about 28 cubic feet. With the introduction of inverted incandescent burners and mantles, and the consequently small consumption (0·4 cubic foot per hour for each burner), the solution of the problem of lighting railway carriages appears to have reached its most economical point.

When in these days we speak of high-pressure gas, it rather conveys to the mind at the first thought the high pressures in pounds per square inch, as those of which we have just been speaking. But modern high-pressure gas, as is now known and utilized, does not approach such heavy compression, and to my mind it is rather a misnomer, and a pity that we should call it high pressure. It would be, I think, better described as reinforced gas—that is, gas taken at a pressure of (say) 2 inches in the mains, and increased by compression to (say) 50 inches of pressure. Until experiments had shown the advantage that could be obtained in flame temperature by using forced-pressure gas, the best results were secured by compressing air and forcing it to unite with the low-pressure gas, as distributed from the town mains, in bunsen burners, arranged as in the ordinary blow-pipes; and this type of burner is the one chiefly used for gas-furnace work.

Perhaps at this point it will be interesting to give you some idea of what ordinary town pressure really means. Up to fifteen years ago, 2 inches of water pressure in a town supply was considered high; but 2 inches of pressure is more than double that necessary for all the old conditions under which gas was used. The earlier burners of the fish-tail type, numbered 1, 2, 3, 4, and 5, were constructed to burn 1, 2, 3, 4, and 5 cubic feet of gas per hour in accordance with their number, at a pressure of only 6-10ths of water. This pressure was sufficient to spread the flame, and give the most economical illuminating results. One inch of pressure means only $\frac{1}{2}$ oz. per square inch. Two inches of pressure, which is too high for an ordinary flat-flame burner, is only $1\frac{1}{10}$ oz. per square inch; while the highest pressures to be obtained from the largest gasholders do not exceed 10 inches—just half the pressure that can be exerted by the human lungs.

Now, with reinforced gas, we use pressures varying from 12 inches of water, equal to 7 oz. per square inch, up to 60 inches of water, equal to 33 oz. per square inch. So that the maximum pressure at which so-called high-pressure gas is used is only 2 lbs. per square inch. All existing gas mains and pipes, if properly laid in the first instance, are structurally quite capable of withstanding a much higher pressure; and I see no reason why still higher pressures should not become universal, provided the fittings and joints are made more carefully than has been the practice hitherto in dealing with low pressures of from 1 oz. to 2 oz. per square inch. We already know that for flat-flame burners low pressures not exceeding $\frac{1}{2}$ oz. per square inch are necessary, in order to preserve the shape of the flame; so that reinforced pressure gas is useless for flat-flame burners. But with the bunsen burner, and the incandescent mantle used with the bunsen burner, we have arrived at the conclusion that the higher the pressure the better the result.

With the introduction of the air-blast to bunsen burners, blow-pipes were found to give better results—in other words, a higher flame temperature was obtained; but used on a large scale in factories, the necessity of putting down air-compressing plant or foot-bellows for each blow-pipe and running a system of air-blast pipes throughout the works is a costly matter. This is an arrangement that is open to some objections on the score of the danger when negligently handled. At any time there is a possibility, when the air-blast is stopped, of the gas, which is delivered at a pressure of about 1 oz. per square inch above atmospheric pressure, finding its way into the system of air-pipes, thus forming an explosive mixture, which may become ignited and cause a dangerous explosion. Again, by stopping the outlet of the blow-pipe and continuing the air-blast, which is at a pressure of 12 or 13 inches of water, air may be forced back into the gas-pipes, forming an explosive mixture in the gas-pipes or meter, when a similar explosion may then result. With reinforced gas we get similar advantages as regards flame temperatures without the disadvantages and risks of the air-blast system. Thus in factories, on the introduction of reinforced gas, we are able to avoid the necessity for air-bellows or blower, and can dispense with the requisite power to drive the blower; and there is no need for a separate system of air-conduits, while all risk of explosion in the air or gas pipes through careless handling, or the leakage of gas through the valve in the blow-pipe, is done away with. With a blow-pipe, by a very simple adjustment, it may be easily arranged so that the flame can only be ignited when held by the workman in the proper position for doing his work; and when placed on one side after the brazing or heating is completed, the gas may be automatically turned off.

In employing reinforced gas for other apparatus than blow-pipes and brazing, we are able to use it directly in all existing blast-furnaces, muffles, annealing furnaces, &c., with an absolute certainty of temperature that can only with difficulty be obtained when similar results are attempted with air-blast, for this reason: Reinforced gas can be adjusted by reliable governors to one constant delivery pressure; and as the thermal value of town gas and atmospheric conditions vary so slightly, furnace temperatures, when once adjusted, remain practically invariable. With air pressure, the use of a large number of furnaces or blow-pipes at the same time affects the general pressure, through the air system, with the result that the flame temperature of the burners falls off, and the burners are sometimes liable to light-back at perhaps the critical time, when least desired.

With reinforced gas, we avoid all the inconveniences of back-lighting, and we also avoid the necessity of any adjustment of the air supply after the burner has once been adapted to the furnace. The danger of baffling-out the forced pressure flame by opening or closing the door of the stove or oven is overcome; and an absolute temperature can be automatically controlled in japanning or heating ovens by the use of a thermostatic valve.

The past seven years have seen great alterations in the methods of conducting the business of our city gas undertaking, now well to the front in all matters connected with the commercial uses of gas. Not only have reduced charges been made for gas used for

lighting, but specially low rates are now charged for gas used for motive power; and within the past few weeks a further concession has been made to manufacturers in the price charged for gas used for heating in various manufacturing processes. In furtherance of this forward policy, laboratories have been established by the Gas Department, and research work undertaken in many directions; and much has been accomplished in developing the resources of coal gas, and increasing the field of its utility and value to the public. In this connection, in order to eliminate the cost to the public of increasing gas pressure by private installations, the Gas Department are now erecting plant for supplying gas at forced pressure throughout a large district; and thus the cost of compressing plant and separate systems of air conduits, bellows, &c., and the space they now occupy, will be saved to consumers from the new system of mains. In addition to the advantages to be obtained by using reinforced gas for manufacturing purposes, all the advantages of improved lighting at a lesser cost will be available a few months hence.

In reinforced gas lighting, we find that the illuminating power of the ordinary incandescent mantle is considerably increased; and while we obtain 20 candles per cubic foot of gas at ordinary town pressure, we are able to increase this to 30 candles per cubic foot at 12 inches pressure, rising to 50 candles per cubic foot of gas used at 60 inches pressure. The increased flame temperature seems to add to the life of the mantle by the hardening of the fabric; and the reduced cost of maintenance with reinforced gas, as compared with gas at ordinary pressure, is noticeable.

Experience proves that with reinforced gas it is desirable that the delivery of the gas shall be at a constant pressure. For this purpose, governors are an advantage; and with them, having once adjusted the pressure to the desired point at the outlet of the governor, no further attention in this respect is necessary.

The inverted burner seems specially adaptable for reinforced gas lighting, and, indeed, has come to the front of late so rapidly as to very largely displace the original vertical burners. At the present time, under ordinary town pressure, we are able to get results from incandescent inverted burners for factory lighting that are astonishing. For instance, with the ordinary small size inverted mantle, and a gas consumption of 1¼ cubic feet per hour, giving an illuminating power of 15 candles (more than sufficient for any ordinary lathe, stamping, or sewing machine), with gas at 2s. 4d. per 1000 cubic feet, we can light twenty-six machines for 1d. per hour; and when such small inverted burners are provided with anti-vibrators, the life of the mantles in a reasonably dry atmosphere may be safely calculated, excepting always accidental breakage, at six months. With reinforced gas, where ½ cubic foot per hour only is used, we are able to provide 70 lights at a cost of 1d. per hour. It seems therefore that this type of burner, with a small consumption and a small mantle, is the one that will become the most suitable for factory work, where a separate light is required for each machine.

For the general lighting of factories, in which work is principally done at benches, where vices and other apparatus are used, and where distributed light is necessary, an ordinary large-sized inverted mantle and burner consuming 3 cubic feet per hour at ordinary town pressure gives a light of 60 candles, and such lights placed 10 feet apart are ample for all requirements. We are able to light 100 feet of benching with nine lights at a cost of ¾d. per hour, with gas at 2s. 4d. per 1000 cubic feet; while with reinforced gas the consumption is still further reduced to 1¼ cubic feet per light per hour, and the cost of lighting the same amount of benching comes to less than ¼d. per hour. With an installation carefully arranged in the first instance, and with occasional attention on the part of an individual who understands that an incandescent burner requires to be kept clean and free from dust, such results as I have mentioned are certain.

In street lighting, we have yet in this country to realize the full value of reinforced gas with inverted burners, and are more accustomed to the excellent results obtainable from vertical burners. In Berlin, inverted reinforced gas lighting is predominant; and those who have seen the splendid results in the 40 miles of streets lighted in that city under the newest systems, are convinced that in this direction we have yet to make progress in this country.

The life of a well-built inverted mantle is considerably longer than that of a vertical mantle; and by the adoption of inverted mantles maintenance is reduced to a minimum. I frequently have brought before me instances where vertical mantles have lasted twelve months under ordinary pressure; and I have no reason to doubt that these remarkable results will be surpassed in the future by the use of inverted burners and mantles.

For large centres of light, such as in public halls, with reinforced gas there seems to be a huge field; while for domestic lighting, with a small consumption and resultant small effusion of heat, reinforced pressure answers the requirements of the public for a brilliant light with no increase in the temperature of the room. I feel that with the introduction of reinforced gas lighting we can look forward to a new era, and to fresh fields in the development of the gas industry which will enable it to maintain its position as the best and most economical form of artificial lighting yet discovered. But as the best results are only to be obtained by the higher perfection of the apparatus employed, so also these results will depend on the more careful installation and maintenance of them. Gas-fitters of the present day must realize that they have reached a time when old rule-of-thumb methods have passed, and that it is absolutely necessary for them to become acquainted with the principles underlying the improvements, and the application, of the modern apparatus now so rapidly being brought forward in connection with the distribution of gas for light, heat, and power.

Illustrating the simplicity of the appliances necessary, and the speed with which the high heats required in various manufacturing processes could be obtained with reinforced gas, the lecturer showed various forms of muffles built up with ordinary firebricks, in which the brazing of tubes, the melting of glass, copper, and cast iron, and jeweller's enamelling work had been performed. The results of these experiments were inspected by the members with interest. It was mentioned by Mr. Barrett that, with reinforced gas, a temperature sufficient for ordinary tool hardening could be maintained with a consumption of 25 cubic feet per hour. The burner necessary was of the most simple construction.

Replying to questions asked at the conclusion of the address, Mr. Barrett stated that, according to the arrangement for reinforced gas at present sanctioned by the Corporation, the high-pressure mains would be run in the centre of the city. It was hoped that the supply would be available in the course of four or five months, after which it was possible that extensions would be made to other districts. The first mains laid formed only a portion of a very much larger scheme; and it was hoped that gradual development would speedily follow. This would, of course, depend upon the appreciation of the efforts made by the Gas Committee to please their consumers. The pressure given would probably be about 60 inches.

A vote of thanks to the lecturer was proposed by the Chairman (Mr. J. Thacker), seconded by Mr. Wiltshire, and carried with acclamation.

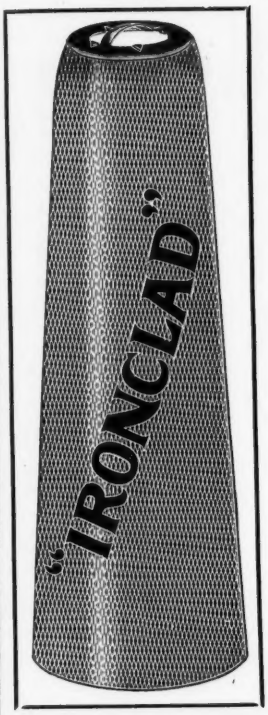
In his response, Mr. Barrett again impressed upon the members the necessity of their keeping themselves abreast of the times. They must nowadays possess knowledge and power. Even the reputation for good workmanship would not be sufficient in the future. It must be good and up-to-date work; and it was essential that the trade should make themselves acquainted with the principles underlying their work. They should possess a knowledge of the principles of combustion and the actual movements of gases under pressure, and should know how to calculate the dimensions of necessary pipes and the capacities of certain furnaces. The time had gone by when gas-fitters could go into factories and experiment with brazing furnaces. Nowadays, before an order was given, a guarantee was obtained. No well-managed cycle factory would place an order for 150 or 200 furnaces without an assurance as to results and knowledge that the maintenance would be simple. This was why he thought that, with reinforced gas, the Birmingham Gas Department were helping the trade a very great deal in removing the necessity for complicated air pressures and bunsen burners. All the compressing arrangements would be concentrated at the gas-works; and the gas-fitter would be dealing with simplified arrangements. Care and observation, however, were essential. Cleanliness in fitting up the apparatus was most necessary. They must get up to date and take a pride in their business, and if possible bring forward improvements themselves to assist manufacturers in the use and gas companies in the supply of modern gas.

The Assistant-Engineership at Wellington (N.Z.).

We are pleased to announce that Mr. Archibald Dougall, the Chemist and Second Assistant at the Hull station of the British Gaslight Company, has been appointed Assistant-Engineer of the Wellington (N.Z.) Gas Company. He is the eldest son of Mr. Archibald Dougall, of Kidderminster, and nephew of Mr. Andrew Dougall, the predecessor of Mr. John Young at Hull. He was trained at the Midland University, Birmingham, was engaged for some little time at the Kidderminster Gas-Works, and in 1899 obtained the appointment at Hull. Three years ago, the Technical College there included gas in their syllabus of education, and Mr. Dougall was appointed lecturer on this subject; and his pupils have been very successful in passing examinations. He has succeeded in winning the respect and esteem of all those with whom he came in contact. The Directors of the British Gaslight Company presented him with a cheque to emphasize their good wishes for his future welfare; the workmen gave him a beautiful illuminated address and a case of cutlery; his brother officials were the donors of a prismatic field glass and case of pipes; and the Secretary (Mr. A. W. Brookes) and the Engineer also offered him tokens of their regard. Mr. Dougall and his wife (who is a daughter of the late Mr. Andrew Dougall, of Hull) are expected to sail for their new home on the 23rd of December. In the meantime, Mr. Dougall has been commissioned to visit a number of works, both on the Continent and in this country, to inspect the latest methods of gas manufacture.

Manchester and District Junior Gas Association.—We learn from the Secretary (Mr. J. Alsop) that arrangements have been made for the members to inspect the gas-engine works of Messrs. Crossley Bros., at Openshaw, Manchester, on Saturday. The next "Coffee" meeting will be held on Tuesday, the 14th prox., at the Cities Café, Deansgate; the subject for consideration being "Gas-Works Chemical Tests."

THE



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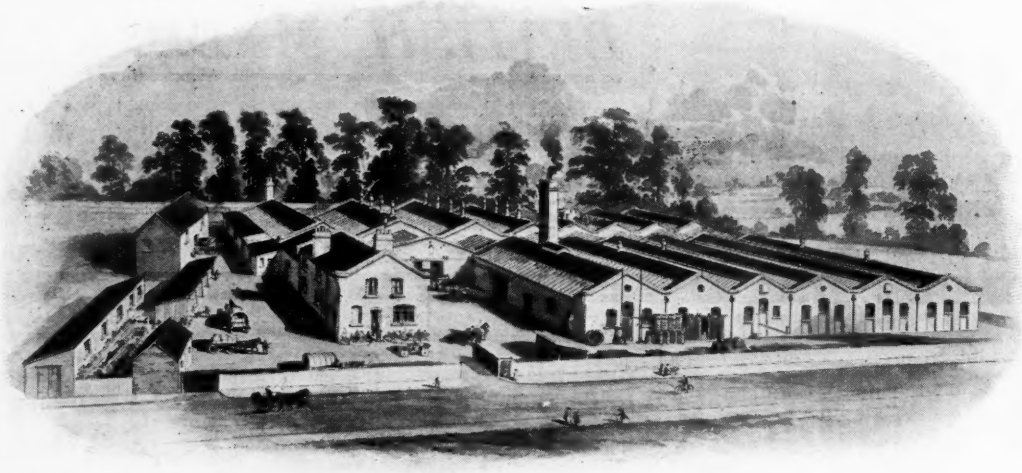

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THE DESIGN AND CONSTRUCTION OF THE LARGE GASHOLDER TANK AT MANCHESTER.

Paper by Mr. Frank H. Robinson.

At a Meeting of the Manchester Association of Students of the Institution of Civil Engineers, held on Wednesday last, Mr. FRANK H. ROBINSON, Stud.Inst.C.E., Engineering Assistant at the Manchester Corporation Gas-Works, read the following paper on "The Design and Construction of the Large Gasholder Tank at Manchester." The chair was taken by Mr. J. G. NEWBIGGING, M.Inst.C.E., President of the Association.

Before commencing a description of the work, it will be as well to give a few facts which influenced the Gas Committee of the Manchester Corporation, and their Engineer (Mr. J. G. Newbigging, M.Inst.C.E.) in deciding to erect a holder of such large dimensions.

It is an axiom among gas engineers that a gas undertaking should have storage for at least one day's maximum consumption of gas. This gives a feeling of security to the manager, conduces to good, regular working, and gives facilities for shutting-down the plant for a portion, if not for the whole, of Sunday. For several years past, Manchester has not been in this position. In December, 1904, owing to a week's continual fog, the consumption of gas reached 27,250,000 cubic feet in the 24 hours; while the storage capacity for the four works was but 24½ million cubic feet, and the productive capacity about 24 millions. The productive capacity at this time was about 2½ million cubic feet less than normal, owing to a portion of the Gaythorn plant being under reconstruction. It will thus be seen that there was very little reserve for emergencies, such as the one stated above. This was very forcibly demonstrated then; for on the last day of the foggy weather, there were but 580,000 cubic feet of gas in stock at 11 p.m., or barely half-an-hour's supply of gas for the city.

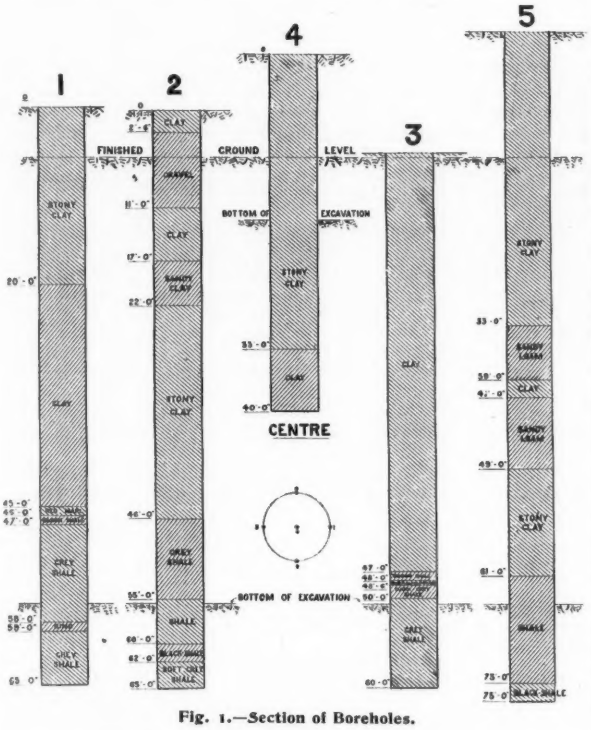


Fig. 1.—Section of Boreholes.

It was then decided to increase the storage capacity, and make it sufficient for some years to come. The question now arose as to which would be more economical, both as regards land and money—to erect one large holder, or two or three smaller ones with a total capacity equal to the larger one.

The figures given below show clearly that the advantage lies on the side of large holders:—

		Capacity. Cubic Feet.	Cost per 1000 Cubic Feet.
Manchester	1 holder (Gaythorn)	1,500,000	£13 16 0
,,	1 ,, (Bradford Road)	7,000,000	9 15 5
Sheffield	1 ,,	8,113,600	6 10 7
Edinburgh	1 ,,	8,500,000	8 8 11
Devonport	1 ,,	1,500,000	11 6 1
Manchester (New)	1 ,,	10,410,000	8 0 6

These figures cover the cost of tank, inlet and outlet pipes, tank framing, holder, and guide-framing.

It was finally decided to erect a holder at the Bradford Road works of 10 million cubic feet capacity, having the following dimensions, &c.: Tank, of brick and puddle on concrete foundations, 285 feet internal diameter and 46 ft. 6 in. deep to the underside of the footings. Framing of steel. Holder, four-lift, each lift about 43 feet deep, with steel guide-framing.

SITE.

Having now fixed the general dimensions of the structure, the next question was to find a good site—one which would be satisfactory from the engineering point of view, and one which would suit the arrangement of the new works to be erected on the adjoining land. This was found at the north-eastern extremity of the works, where the land is about 8 feet above the level of the rest of the works.

Five boreholes were sunk to ascertain the nature of the strata beneath, each hole being 4½ inches in diameter, and ranging from 50 to 80 feet deep. One was in the centre, and the remainder at equidistant points round the circumference of the tank. The boreholes showed the strata to be: First, boulder clay, then thin bands of marl and black shale, and, finally, grey shale at the lowest section. A section of the boreholes is shown on Drawing No. 1. Such ground as this is very suitable for a brick and puddle tank as projected.

GASHOLDER TANK.

This consists of a circular brick tank backed with puddle, and having a cone or dumpling in the centre on which rests a steel framework. On one side there are two pipes, 42 inches in diameter, forming the inlet and outlet of the holder. When the trench for the wall is excavated to the full depth, a layer of puddle, 12 inches thick, is spread over the whole bottom, well punned and watered, and left perfectly level. Over the dumpling, the puddle is 18 inches thick where the bed is shale; where the bed is clay, the surface of the clay is excavated with a tool for a depth of 12 inches, puddled, watered, and well trodden down. On the puddle is a bed of concrete (5 to 1), 30 inches thick under the walls and 9 inches thick on the dumpling, special blocks being formed on the latter to receive the tank-framing.

The footings are eight courses deep throughout. The main wall is 7 bricks thick at the bottom for a height of 16 ft. 6 in. above the footings—*i.e.*, just above the centre of pressure. Above this point, it is reduced by one-half brick every 4 feet up, the top section being 3½ bricks thick. The total height of the brick wall is 44 feet from the top of the footings.

At equidistant points round the circumference, there are 32 piers projecting outwards, to support the standards of the holder guide-framing. These piers are 11½ bricks deep and 8 bricks wide for the full height; they also serve the purpose of stiffening the tank wall. In addition to these main piers, there are 32 intermediate piers for stiffening purposes. They are 7 bricks deep and 5½ bricks wide. The brickwork is laid in cement mortar (3 to 1), and built in old English bond. Behind the wall is puddle 2 ft. 6 in. thick. The puddle serves to make the tank watertight, while the brickwork is for strength and for preserving the circular form of the tank.

PRINCIPLES OF TANK CONSTRUCTION.

Let us now consider the principles governing the design of gasholder tanks in general, taking the present one as an illustration. The forces and resistances to deal with when designing a tank of this description are, on the one side the pressure of the water, and on the other side (1) resistance of the earth-backing, (2) resistance due to the weight of the wall, and (3) resistance due to the cohesion of the material. It is evident, then, for stability and a reasonable margin of safety, together with a tight tank, the last three items added together must greatly exceed the water pressure. To ascertain if this be the case, Pole's formulæ are often applied. For consistency, the symbols use in these and in subsequent formulæ are made alike; the formulæ otherwise remaining the same as quoted in gas engineering text-books.

Let d represent the internal diameter of tank in feet.
" D " " external " " "
" T " " thickness (average) of tank wall in feet.
" H " " height " " "
" R " " resistance to compression of earth backing in pounds per square foot.
" F " " ultimate cohesive strength of material in pounds per square foot.
" B " " weight of brickwork in pounds per cubic foot.
" W " " " " water " " "

Taking the moments about the outer bottom edge of the wall, immediately above the footings, we get—

(A) Moment of water pressure $= W d \frac{H^3}{6}$

(1) Moment of resistance of earth-backing $= R D \frac{H^2}{2}$

(2) " " " due to weight of wall $= B D H \frac{T^2}{2}$

(3) " " " " cohesion of materials $= F H^2 T$

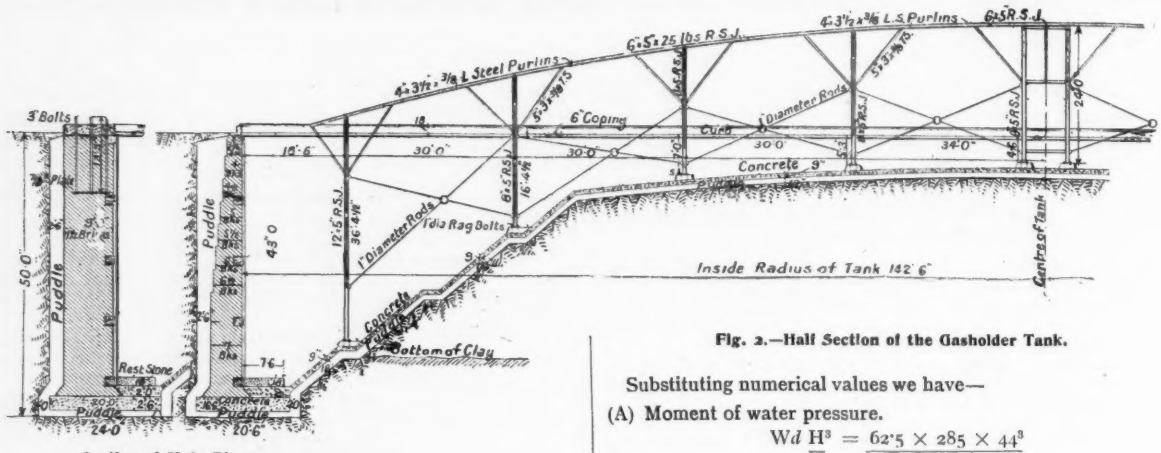
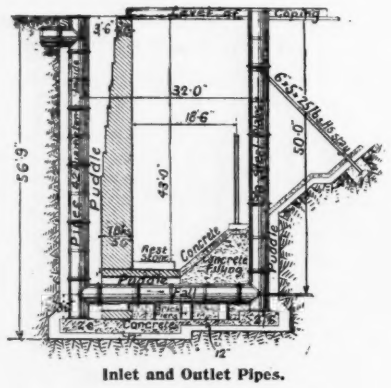


Fig. 2.—Half Section of the Gasholder Tank.

Section of Main Piers.



Inlet and Outlet Pipes.

Applying these to the tank described, we get—

d	=	285	feet
D	=	294	,,
T	=	4½	,,
H	=	44	,,
R	=	1,200	lbs. per square foot for puddle or clay
F	=	31,680	,, ,, ,, bricks in 3 to 1 compo.
B	=	112	,, ,, cubic foot
W	=	62·5	,, ,, ,,

It will be noticed that the average thickness of the wall is taken. This is to simplify the calculations.

The position of the centre of gravity of the wall when considered of uniform thickness is but 1 inch away (vertically) from its actual position; so that the error introduced is small, especially as the item affected is (2), which forms but a small portion of the total resistance.

Substituting numerical values we have—

(A) Moment of water pressure.

$$\frac{W d\, H^3}{6} = \frac{62{\cdot}5 \times 285 \times 44^3}{6 \times 2240}$$

,, = 113,000 tons-feet.

(1) Moment of resistance of earth-backing.

$$\frac{R\, D\, H^2}{2} = \frac{1200 \times 294 \times 44^2}{2 \times 2240}$$

,, = 152,460 tons-feet.

(2) Moment of resistance due to weight of wall.

$$\frac{B\, D\, H\, T^2}{2} = \frac{112 \times 294 \times 44 \times 4{\cdot}5^2}{2 \times 2240}$$

,, = 6550 tons-feet.

(3) Moment of resistance due to cohesion.

$$\frac{F\, H^2\, T}{2240} = \frac{31{,}680 \times 44^2 \times 4{\cdot}5}{2240}$$

,, = 123,200 tons-feet.

Adding the last three items together, we get a total moment of resistance of 282,210 tons-feet, or almost 2·5 times the moment of the water pressure. This is the factor of safety immediately above the footings, assuming that the earth-backing is boulder clay for the full depth. As, however, the lower stratum is here of shale, this factor of safety will be very much higher; the shale found being of a very hard description with entire absence of "faults."

The author has prepared a graph (fig. 4) illustrating the gradual increase of the factor of safety towards the top of the tank, showing that the thickness of the tank wall might be reduced to a feather-edge at the top. This, of course, is not carried out; for the side of the tank acts as a retaining wall to the earth-backing when the tank is empty, the surrounding ground being also subjected to rough usage during the erection of the holder. Also, if the top of the wall were made very thin, the thickness of it would require increasing at the base to obtain the necessary cross area. Thus there would be extra excavating and puddle without any great saving in brickwork. Moreover, if very thin at the top, the masonry would not be able to withstand the weather.

The above formulæ take no account of the support offered by the main piers, or of the cohesion at the base of the wall. For a

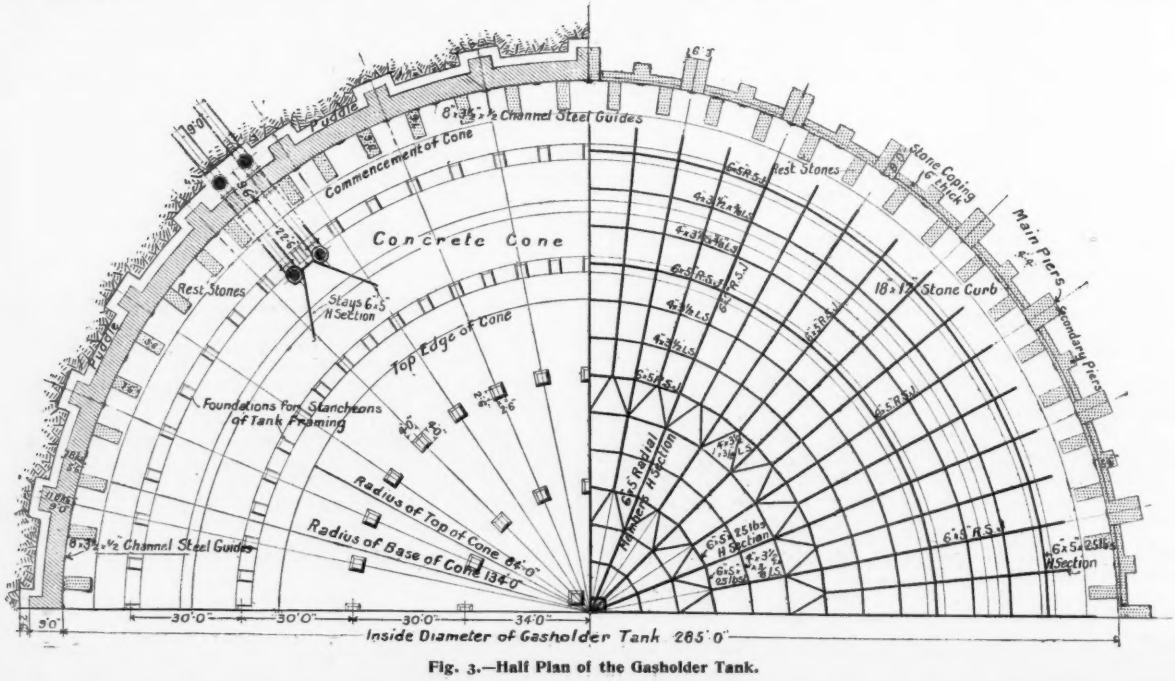


Fig. 3.—Half Plan of the Gasholder Tank.

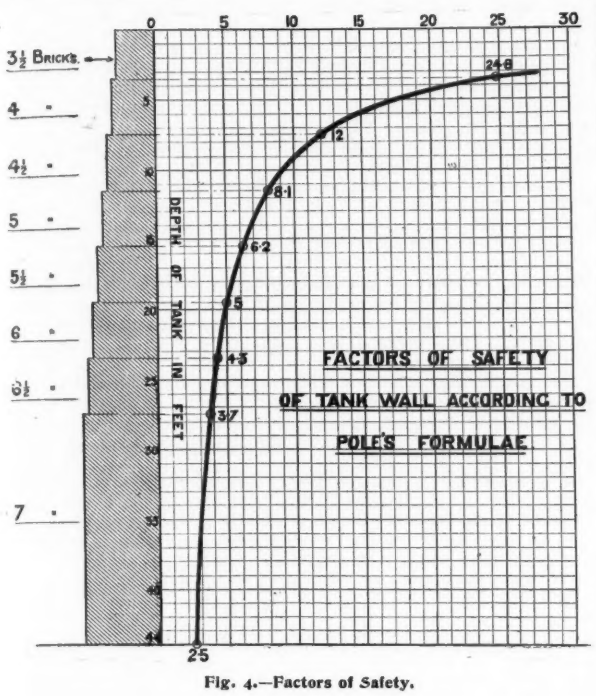


Fig. 4.—Factors of Safety.

large tank with counterforts such as the one described, the author would prefer to base his calculations on one section only of the wall, between two of these piers (shown shaded on the diagram), and allow for cohesion at the piers on either side of this elementary strip, and at the base just above the footings; for in case of failure, one of these sections would be the first to go. In other words, the author would consider one bay as a dam with earth backing.

Let L represent the length in feet of one of these sections between the piers. The other symbols are as used in previous formulæ.

(A) Moment of water pressure on section $= W.LH.\frac{H}{2}.\frac{H}{3}$

" " " $= W\,L\,\frac{H^3}{6}$

(1) Moment of resistance of earth-backing $= R.LH.\frac{H}{2}$

" " " $= R\,L\,\frac{H^2}{2}$

(2) Moment of resistance due to weight of wall $= B.LHT.\frac{T}{2}$

" " " " $= B\,LH\,\frac{T^2}{2}$

(3) Moment of resistance due to cohesion at piers $= 2 \times F.HT.\frac{H}{2}$

" " " " $= FH^2T$

(4) Moment of resistance due to cohesion at base $= F.TL.\frac{T}{2}$

" " " " $= F\,L\,\frac{T^2}{2}$

The length L is found to be almost 22 feet measured at the centre of the wall. There is a difference of 12 inches between the outside and inside lengths of this section; but the author is of opinion that resistance of the earth-backing is scarcely effective for 6 inches on either side the piers, owing to the friction against these piers and the difficulty of getting the backing quite tight into the corners. The average length L is therefore taken, for these reasons and for simplicity, as being a dimension common to four out of the five items.

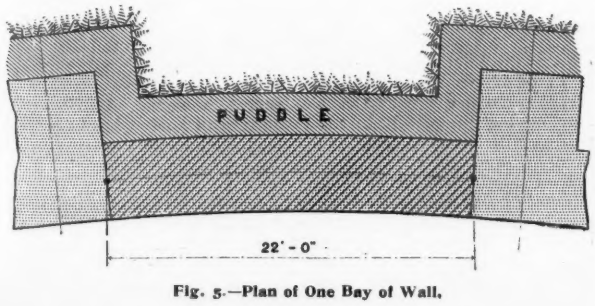


Fig. 5.—Plan of One Bay of Wall.

Substituting numerical values, we get—

(A) Moment of water pressure $= W\,L\,\frac{H^3}{6}$

" " $= \frac{62{\cdot}5 \times 22 \times 44^3}{6 \times 2240}$

" " $= 8715$ tons-feet.

(1) Moment of resistance of earth-backing $= R\,L\,\frac{H^2}{2}$

" " " $= \frac{1200 \times 22 \times 44^2}{2 \times 2240}$

" " " $= 11{,}410$ tons-feet.

(2) Moment of resistance due to weight of wall $= B\,L\,H\,\frac{T^2}{2}$

" " " $= \frac{112 \times 22 \times 44 \times 4{\cdot}5^2}{2 \times 2240}$

" " " $= 490$ tons-feet.

(3) Moment of resistance due to cohesion at piers $= F\,H^2\,T$

" " " $= \frac{31{,}680 \times 4{\cdot}5 \times 44^2}{2240}$

" " " $= 123{,}213$ tons-feet.

(4) Moment of resistance due to cohesion at base $= F\,L\,\frac{T^2}{2}$

" " " $= \frac{31{,}680 \times 22 \times 5{\cdot}4^2}{2 \times 2240}$

" " " $= 4536$ tons-feet.

In calculating the resistance due to cohesion at the base, the full thickness of the wall has been taken, not the average thickness as in (2) and (3).

Adding the last four items together, we get 139,649 tons-feet as the total moment of resistance, or a factor of safety of 16, compared with 2·5 when Pole's formulæ are used. This clearly shows the great assistance offered by the piers or buttresses.

The above calculations apply when the tank is filled with water and the brickwork thoroughly set. It is obvious that the tank must also be able to withstand any other stresses before it is filled and while the work is "green." While the inner portion of the tank is being taken out, the earth backing will be exerting a thrust on the back of the wall. This must be counterbalanced by the weight of the wall, and the cohesion of the comparatively "green" material, which might be taken as having half its ultimate strength (say) for the first four months while the inner portion is got out, or a tensile strength of 15,840 lbs. per square foot.

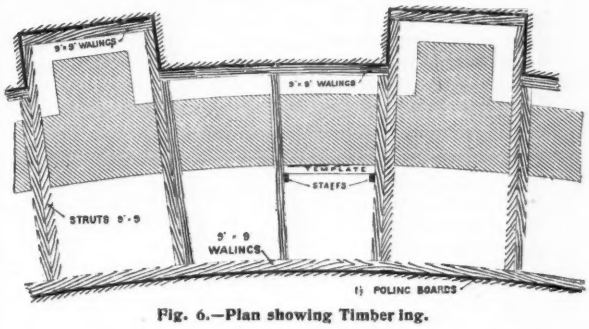


Fig. 6.—Plan showing Timbering.

The mass of earth pressing on the tank wall behind this length of 22 feet would be 570 tons (22 ft. by 44 ft. by 11 ft.) with its centre of pressure 14 ft. 8 in. up the wall. Then:—

	Tons-Feet.
Moment of pressure of earth $= \frac{570}{1} \times \frac{44}{3}$ ...	8,360
(1) Moment of resistance due to weight of wall ...	490
(2) " " " cohesion at piers...	61,617
(3) " " " " " base...	2,268
	64,365

This gives a factor of safety of 7·7 which shows that safety is insured without waste of material. It will thus be seen that the tank is safe whether full or empty, and that the safety depends almost entirely on the cohesion of the material. The opposing forces—those of earth and water—are about equal in this case with such a backing. The other items are merely resistances, and come into play whether the tank is full or not. The slight curve on this elementary section will also assist the wall to withstand the earth-pressure behind; but as the work is "green" and the value of such assistance can scarcely be estimated at such a time, it is better ignored in the calculations.

The calculations of the resistance due to cohesion are based upon the ultimate tensile strength of brickwork in cement, which is considerably below the ultimate compression stress. There is therefore no necessity to see whether the resultant pressure falls within the middle third of the base. Further, the conditions are different to those in a long straight wall. From the above, it is evident that the thickness of the tank wall is determined by the nature of the surrounding backing and the height of the wall.

It will be seen that the use of Pole's formulæ is but a rough and general method, only suitable for comparatively small tanks where a little extra brickwork is not of much moment. It gives a factor of safety far below the true one; so running up the cost without necessity. The author is of opinion that in many gas-holder tanks, where Pole's formulæ have been used to ascertain the thickness of the wall when designing the tank, much expense might have been saved without endangering the safety of the structure or tightness of the tank—provided, of course, that due allowance was made for the nature of the surrounding strata.

Sundry Details of Construction.

In this tank, no dry well or recess is provided for the outer legs of the inlet and outlet pipes; the circle of the tank being unbroken save at the bottom where the pipes are taken through two circular tunnels in the bottom of the main wall and up through the puddle outside. Puddle is well rammed round the pipes, both in the tunnels and outside, after previously supporting the horizontal portions of the pipes by small brick piers.

The break in the bottom of the wall for the entrance of the inlet and outlet pipes constitutes a weakness in masonry tanks. Some engineers prefer to recess the tank wall, and some to construct a dry well sufficiently large to admit of the inspection of the pipes. Where the pipes are sufficiently large for inspection from their inside, the simplest and safest method is the one just described.

Six steel holding-down bolts are provided to each main pier for the standards, 3 inches diameter and 13 ft. 3 in. long, with a $\frac{7}{8}$-inch steel plate built in the wall at their lower ends.

The stone used is Fletcher-Bank stone. The guide-stones, 320 in number, are built in the wall with a 3-inch projection from the face. Before the channel-guides for the holder are bolted to these, they are dressed off to about $2\frac{1}{2}$ inches, till each is perfectly plumb over the one below.

The rest-stones at the bottom are for the purpose of receiving the holder when not in use. There are 64 in the circumference; all being level with each other and rounded on the arris.

The tank wall is covered with a coping 6 inches thick, with a circular topped curb, 18 inches by 12 inches, each section being secured to its neighbour by slate dowels run in cement.

The main pier stones, 32 in number, are 9 feet long, 6 ft. 3 in. wide, and 2 feet thick.

The "dumpling" is formed after the tank wall is built, and has a slope of 40 degrees with the horizontal. It is built in three steps, finishing with a rounded top, as shown in Drawing No. 2.

Six overflows for the excess of water are provided round the side of the tank.

Tank-Framing.

For the purpose of receiving the weight of the holder crown when the holder is supported on the rest-stones at the bottom of the tank, a steel framework is fixed on the dumpling. It is formed of rolled steel stanchions, rafters, and purlins of various rolled sections, braced across with wrought-iron rods and rings. The purlins and rafters are bent to suit the spherical form of the holder crown. In the centre is a square framework formed of rolled steel joists from which the whole tank framing radiates.

Construction.

Having now described the design, an account will be given of the method of constructing the tank. The work was commenced on Nov. 11, 1907. The Corporation set apart 37,428 square yards of land for the Contractor's use; and he fenced it off from the rest of the works. The site was first levelled; and the clay removed was piled up at one side to weather. A circular trench, 16 ft. 6 in. wide and 50 feet deep, was set out and cut, with recesses for the main piers, and a deeper pit for the inlet and outlet pipes. The sides of the excavation were close-timbered and well strutted as the excavation deepened.

Round the outside of the tank rails were laid, on which ran travelling cranes and bogies for material; the brick-making plant, pugging mills, concreting stages, &c., being placed in convenient positions adjacent to the rails. A connection was also made with the railway sidings of the Corporation. The excavating was done by hand, the material being filled into skips, hoisted by means of steam travelling cranes, dropped into bogies, and stacked for future use. Owing to the confined nature and close-timbering of the trench, and the accuracy with which the trench had to be cut, the use of a steam navvy was impossible.

The excavation for the footings was undercut 2 feet at the outer circumference. As the ground was solid, this was not a risky operation. It meant a great saving in excavating and timbering, and also left the earth behind the puddle undisturbed—an important point where tightness is concerned. The ground was found to be very solid and free from faults and water, fully confirming the bore-holes. Drains and sump-holes had been provided in the contract for dealing with water if it should be found; but, fortunately, these were not required.

Some doubt was entertained as to whether any of the eighteenth century workings of the Bradford coal-seams had been carried sufficiently near the tank to cause anxiety. Headings were accordingly driven from the bottom of the excavation in an outward and downward direction for some 40 to 70 feet at several points in the circle. These headings were cut in the 3-feet coal-seam found at the bottom of the trench. This coal-seam had a dip of 1 in 3. On examination, the headings revealed no danger; so they were filled up with tightly-rammed concrete.

The weathered puddle was taken to the pugmills, where it was well worked and made thoroughly homogeneous. It was then lowered into the excavation, well trodden, watered, and punned with flat punners—being left perfectly level so as to receive the concrete. It is upon the puddle that the tightness of the tank depends, hence the necessity of only the best puddle being used. The whole of the trench bottom was covered with puddle 12 inches thick before concreting was commenced.

The concrete was mixed 5 to 1 on a clean stage, lowered into the trench, well punned, and levelled. The footings were then put in and backed up with puddle, which was well watered and rammed in. The cement mortar for the wall was mixed dry on a platform, then ground in mills, slaked, and mixed again to ensure a consistent mixture. The puddle behind the wall was filled in, watered, and rammed solid as the wall rose. Before the long struts of the timbering were removed, shorter struts were put in against the inside of the wall to support the earth on the inside of the circle. The long main struts were removed and the walings and poling boards taken down. This proceeded just sufficiently in advance of the brickwork to leave working room above.

For the purpose of setting-out the circle of the tank and subsequent plumbing operations, a trammel was used. This was a large fish-backed or bowstring girder of steel sections, and triangular in cross section. The pivot end was of cast-iron, with the fixed portion bedded in a block of concrete, while the free end ran on a single rail laid round the inside of the excavation. A heavy plumb-bob was provided at this end, with a winding arrangement, so that the bottom of the excavation could easily be reached.

In addition to the trammel, staffs and templates were also used; the staffs being nailed to the struts and plumbed-down, and the short templates worked up between them, as shown in fig. 6.

Opinions differ as to the use of the trammel; some preferring to work with a template and plumb-rule only. The author is of opinion, however, that the trammel is necessary if strict accuracy is desired; the possibility of error being greater with a template than with a trammel. In this tank, when the diameter was checked with the steel tape at the completion of the tank wall, it was found to be practically a true circle.

Brickmaking.

The excavated clay was found to be suitable for all the puddle required in the tank and for brickmaking. A brickmaking plant was accordingly erected on the site, capable of making 30,000 bricks a day. The clay is selected from the weathering heap, run along in self-tipping waggons, and emptied into the grinding pan; all large stones being previously taken out by hand. The clay then passes through two sets of grinding rollers, to pulverize any stones or hard material present. From the rollers it passes to the pug-mill for mixing, from which it is forced by a spiral conveyor through a die on to the cutting table. The bricks are then dried in a shed, and run out into the kiln for burning.

The kiln is of the Hoffmann or continuous burning type. It is entirely open, and has only end walls and piers which contain the flues and dampers. The main flues are underground, and pass beneath the piers on to the drying shed—joining together just before entering the latter. To prevent the air passing the wrong way when filling the kiln, the unburnt bricks are plastered over with brown paper. They are then covered on top with a course of red brick and 3 inches of dust; provision being made for feeding the chambers as required with coal or breeze. The gases are drawn through the kiln from the top to the bottom by means of fans, and discharged into the drying shed, no chimney being required. There is thus great economy of fuel with this kiln. The kiln is continuous; the heat passing automatically from one division of the kiln to the next. The divisions are emptied as the bricks therein are burnt, and charged with a fresh batch ready for the time when the heat again reaches that section.

The bricks produced were, on the whole, of a very good quality, extremely hard, well-shaped, and generally superior to the local common brick. A royalty was paid to the Corporation by the brickmakers, Messrs. H. Harrison and Sons, on every 1000 bricks made.

Materials Used, and Cost.

The following list gives the principle quantities of work and materials required:—

Excavating to level site	29,960	cubic yards.
,, ,, circular wall trench	30,380	,, ,,
,, ,, centre of tank	48,500	,, ,,
Puddle behind wall and to dumpling	10,000	,, ,,
Concrete, 5 to 1	4,000	,, ,,
Brickwork in cement mortar, 3 to 1	9,000	,, ,,
Stonework	10,225	,, feet.
Steel inlet and outlet pipes	51	tons.
,, and iron tank framing	258	,,

Capacity of tank, about 9 million gallons.

The contract amount, including clearing the ground but excluding the inlet and outlet pipes and tank framing, is £34,115, or £3 5s. 6d. per 1000 cubic feet of gasholder capacity. Arrangements were made with the Contractor, however, to level the surrounding ground within the fence free of cost if bricks were made on the site. When this matter, the saving in drainage and pumping, and the royalty on the bricks made on the site, are placed side by side with the contract sum and the extras, a final amount of £27,000, or £2 14s. per 1000 cubic feet holder capacity, stands as the approximate cost of the tank itself, to which must be added £4390 as the contract amount for the inlet and outlet pipes and tank framing, giving a total of £31,390 as the cost of all work below the ground level.

The cost may appear high compared with other civil engineering work of a like description; but when it is borne in mind that the work requires the greatest accuracy combined with the best materials, and the circular form of the structure, this high cost may be accounted for. If the tank be not a true circle and perfectly plumb down the inside face of the wall, difficulty will be found with the working of the holder. If the materials be not of the best and the tank leaks, it will be an endless source of expense and often of anxiety.

The Contractors for the tank were Messrs. E. Nuttall and Co., of Manchester, who hope to complete their work in December next, or two years and one month from the commencement of the work.

The contract for the steel work is let to Messrs. Ashmore, Benson, Pease, and Co., of Stockton-on-Tees, who will be expected to finish their work by December, 1910.

The description of the superstructure will be left over to form another paper, subject to the approval of the Council of the Institution.

The author is indebted to Mr. J. G. Newbigging, M.Inst.C.E., who is responsible for the design, for much of the information contained herein, and for permission to submit the drawings accompanying this paper, and also to Mr. W. H. Cummins, who prepared the drawings and quantities, for checking the calculations herein. And, lastly, the author is indebted to his former chief, Mr. Thomas Newbigging, M.Inst.C.E., for many valuable suggestions.

A very animated discussion followed the reading of the paper, in which about a dozen members and students took part.

The PRESIDENT wound up the discussion with the following remarks: The paper which Mr. Robinson has submitted to us this evening is an excellent one, and deals in a comprehensive manner with the forces and resistances coming into play in connection with cylindrical underground masonry tanks, and the principles which should guide us in the design and construction of large gasholder tanks particularly. The author attacks Dr. Pole's formulæ, and not perhaps without some degree of justification. Without a proper appreciation and intelligent use of the formulæ, there is no doubt a danger of excessive waste of material. Though the formulæ are known as Dr. Pole's, it must be pointed out that they originate from the work and investigations of M. Arson, a French engineer, and have been translated by Dr. Pole into English. I am afraid many engineers are apt to follow on beaten tracks; and it is refreshing to hear scientific theories and formulæ attacked. Papers framed on such lines are more interesting than mere descriptions of engineering work. It is well for engineers to overhaul these periodically, in view of the continuous advancement of our scientific knowledge; and if only for that reason, we welcome the paper which has been submitted to us to-night. Gasholder tanks and gasholders are some of the most costly sections of coal-gas manufacturing plant; and it is notorious that contractors who undertake the construction of the tanks are rarely compensated for the work and responsibility involved, in securing a fair profit. This is due, in great measure, to difficulties which invariably await contractors in some form or other during the carrying out of the work, which it is quite impossible to foresee. The author in the early part of his paper gives a list of towns where large gasholders and tanks have been constructed, with their cost per 1000 cubic feet of capacity, which is the usual method of expressing the cost of such structures. It will be noticed that at Sheffield a gasholder and tank with a capacity of just over 8 million cubic feet was constructed at a cost of £6 10s. 7d. per 1000 cubic feet; while the one at Manchester, with a capacity of 10 million cubic feet, will cost £8 per 1000 cubic feet. Such comparisons of engineering structures, without further explanation, are misleading. At the time the Sheffield holder was constructed, the price of steel ruled some £1 14s. per ton lower than at the time the Manchester holder was let by tender. Further than this, local conditions and circumstances rendered it imperative for the Manchester holder to be a more substantial structure than the one at Sheffield. Therefore, in comparing the cost of engineering structures, due regard must be paid to what has been obtained for the expenditure, the cost of the annual maintenance of the structure, and its probable life. The details of the construction of a gasholder tank, whether in concrete or brick and puddle, are largely governed by the type of holder it is proposed to erect. There are two main types of gasholders—one in which it is necessary that a system of steel guide-framing should be erected above the level of the top of the tank, in order to guide the holder to its full height of inflation, and to resist the wind and other forces exerted on the structure; and the other in which no such guide-framing is required. This latter type is known as the spiral-guided holder; the guiding and resistance to strains from wind pressure and other sources being taken up by an ingenious arrangement of guides and rollers in the tank and each lift of the holder. In the construction of a tank to float a spiral-guided holder, it is therefore not essential to build any piers or counterforts as is requisite in the case of a guide-framed holder; the circular wall being usually built in uniform sections. I am not altogether in agreement with the author in laying so much emphasis on the resistance to pressure due to the counterforts. These counterforts are constructed for the sole purpose of foundations for the standards; and though it is obvious that they do strengthen the wall to resist both external and internal pressures, it would not be wise to rely too much on the part they play, and so be induced to reduce the section of the wall between the piers, because, as in the case of a chain being as strong as its weakest link, so is the strength of a tank wall largely as its least sectional thickness, on the line of the centre of pressure. Then, again, with a comparatively light wall adjoining a heavy counterfort, there is danger of rupture occurring at the point where they intersect—such cases coming within the knowledge of engineers. There must, in fact, be some degree of symmetry between the wall and counterfort; and for these reasons I submit that, while fully recognizing the theoretical resistance to pressure due to the cohesion at the counterforts, care must be taken that too much reliance is not placed on the practical effect of this, and other important considerations overlooked. In his method of calculating the resistance of a section of the wall to pressures exerted upon it, the author very wisely allows for the "green" state of the structure. It must be further pointed out that, in the case of a large tank, immediately on its completion, and before the commencement of the erection of the gasholder, it is sometimes tested with water; and due regard must be paid to the effect of this exerting of pressure on the comparatively green structure and its subsequent release, on the emptying of the tank, in order that the construction of the gasholder may be proceeded with. The saving in cost in reducing the thickness of a tank wall by one brick throughout its entire height, is so small a proportion of the total cost that it is not worth any consideration to carry out a cheese-paring policy in design, when it might endanger its practical stability. There is nothing more disheartening to an engineer than to find, on the completion of the construction of a gasholder tank, that, in spite of all his care and foresight, a fracture of the wall occurs, whether of concrete or brickwork, which it is almost impossible to completely repair, and which results in a continual burden of cost in keeping up the level of the water-line, which is essential for the working of the holder. Therefore, in considering the design and construction of gasholder tanks, care must be exercised that, in the endeavour to save expenditure, encouraged by evidence adduced from theoretical consideration, disastrous results do not ensue in putting these theories into practice. Theories and formulæ must all be backed up by practical experience and judgment to make gasholder tank construction successful—as, indeed, these qualifications must obtain in carrying out any engineering work.

AIR POLLUTION BY SMOKE.

In Mr. C. E. Brackenbury's paper given last Tuesday before the Society of British Gas Industries (and noticed elsewhere), he referred appreciatingly to the work done at Leeds by Professor J. B. Cohen and Mr. A. G. Ruston in their investigations into the nature and effect of the pollution of the air in and around Leeds. In view of the present interest aroused in the question of smoke nuisance generally, and as the facts and results of the Leeds experiments may not be familiar to our readers, it will be useful to record them now in our columns.

As long ago as 1897, a paper was read at the Sanitary Institute Congress at Leeds, in which it was shown that an average working day's industrial activity in that Yorkshire city resulted in the emission into the air of 20 tons of soot. Of this amount, half-a-ton was estimated to fall on an area of some four square miles, of which 20 to 25 lbs. remained on the ground and was not washed away by rain.

On July 17 last, before the Bacteriology and Chemistry Section of the Health Congress, Professor Cohen, of the Leeds University, read the paper referred to by Mr. Brackenbury, entitled "The Quantity and Nature of Impurities in the Atmosphere of Leeds and Surrounding Districts." An abstract of this paper appeared in "Nature" for Oct. 14, from which, and other sources, the following particulars are taken.

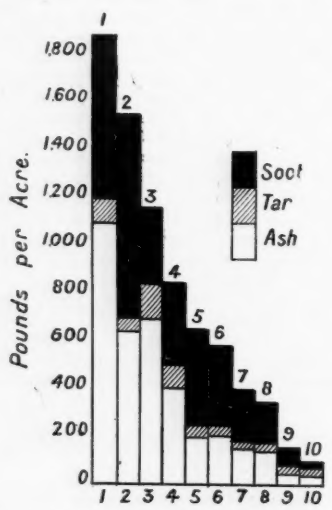
The authors' observations were directed to ascertaining the amount of suspended matter in the air, the analyses of rain water, the influence of industrial centres, the diminution of light and sunshine, and the effect on vegetation by the polluted rain water. Representative stations were selected for the experiments—extending from the heart of Leeds, all through the surrounding residential districts, and reaching to the country at Garforth, 7½ miles due east.

CONSTITUENTS OF POLLUTION.

The impurities of the suspended matter consisted of soot, tar, sand, and other mineral substances. In solution were found sulphurous and sulphuric acids, chlorides (chiefly in the form of hydrochloric acid), and nitrogenous matter, as nitrates or free or albuminoid ammonia. The table on p. 614 shows the results of the analyses of the rain water, the figures being pounds per acre for a year.

At the distance of one mile from the centre of the town, it was found that the total solid impurities fell to less than one-half, and at 2½ miles, to less than one-fifth. Looking at the table, it will be seen that the solid impurities are about twenty times greater at the industrial stations than they are in the residential quarter of Roundhay, which lies about 3 miles north-east. These results, as regards soot, tar, and ash, are graphically shown in Diagram No. 1.

	Collecting Station.	Suspended Matter.	Tarry Matter.	Mineral Matter.	Free Acidity as H_2SO_4.	SO_3.	SO_2.	Chlorine.	Nitrogen as NH_3.	Nitrogen as N_2O_5.	Nitrogen as Albuminoid Ammonia.	Total Nitrogen.
Industrial.	1. Leeds Forge	1886	110	1113	35	123	34	164	13·0	0·0	4·7	17·7
	2. Hunslet.	1565	69	655	90	185	24	198	15·5	0·0	2·9	18·4
	3. Beeston Hill	1163	149	709	30	269	54	101	14·4	0·5	3·5	18·4
Residential	4. Philosophical Hall (town).	849	78	423	45	149	38	75	14·4	0·3	2·2	16·9
	5. Headingley.	659	43	199	11	118	32	41	11·1	1·1	0·8	13·0
	6. Armley .	593	34	216	29	110	37	108	9·9	1·0	3·2	14·1
	7. Observatory	399	32	146	26	85	39	51	8·4	0 8	1·6	10·8
	8. Kirkstall .	352	28	141	8	77	56	57	7·7	0·2	2·3	10·2
	9. Weetwood Lane	147	26	54	11	82	13	34	8·3	1·1	2·1	11·5
	10. Roundhay.	90	14	49	0	53	16	38	5·8	0·7	1·3	7·8
	11. Garforth (country)	—	—	—	28	65	21	22	5·0	3·2	1·1	9·3



1, Leeds Forge. 2, Hunslet. 3, Beeston Hill. 4, Philosophical Hall. 5, Headingley. 6, Armley. 7, Observatory. 8, Kirkstall. 9, Weetwood Lane. 10, Roundhay.

Fig. 1.—Suspended Matter.

The least injurious constituent of the suspended matter is the mineral part of it, which, as would naturally be expected, is exceedingly high at the Leeds Forge. It consists for the most part of oxides of iron, lime, alumina, and silica.

Soot.

In former experiments, to determine the amount of soot deposited, a measured surface of snow was collected and filtered and the soot weighed. The results obtained have been checked by, and have been found to be in agreement with, figures arrived at from analyzing the rain water. Such analyses show that the soot deposited in a year in the industrial district of Hunslet amounts to 300 tons per square mile; while in the semi-residential neighbourhood of Woodhouse Moor (about a mile north-west of the centre), the amount dropped to 80 tons.

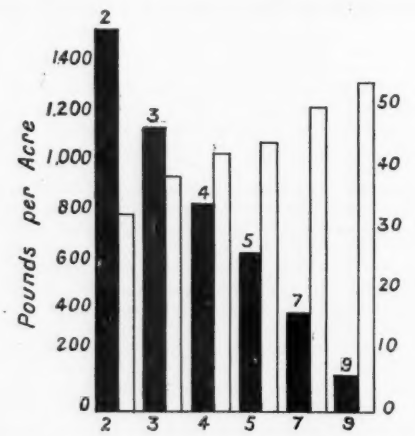
Tar.

To ascertain the quantity of tar, glass plates one foot square were formerly used, being exposed in different points in the town and district. These plates were washed under running water and the residual deposit analyzed, with the result that the amount of soot remaining was found to be 24 times greater in the town than at a distance of 9 miles away. In the later experiments, however, the tarry matter was estimated by extraction with ether; and the result was that the quantity fell from 80 lbs. per acre per annum in the centre to 14 lbs. per acre per annum at a point 3 miles north-east.

"The waste of fuel in the form of unburnt coal passing into the atmosphere must be very large, for," say the authors, "we get in Hunslet each year about 9 cwt. of soot per acre, or nearly 300 tons per square mile actually reaching the ground; while the average amount for the whole area included in the investigation (roughly, 16 square miles, or 4 miles square) works out to 100 tons per square mile."

Reduction of Light.

The next point to receive attention was the important one as to how far the pollution of the air interfered with sunshine and with light. The authors say: "The effect of these impurities in diminishing the amount of sunlight received in Leeds may be gathered from the fact that in 1907 the number of hours of bright sunshine registered at the Philosophical Hall, in the centre of the town, was 1162; while at Adel, some 4 miles north-west, the number was 1396—that is, in the centre of the town we get only



2, Hunslet. 3, Beeston Hill. 4, Philosophical Hall. 5, Headingley. 7, Observatory. 9, Weetwood Lane.

Fig. 2.—Influence of Suspended Matter on Intensity of Light.

83 per cent. of the amount registered 4 miles away." Another comparison showed that the smoke absorbed about a quarter of the total daylight. "The amount of light in Hunslet, where the solid impurities corresponded to 1565 lbs. per acre, was 40 per cent. lower than in the Weetwood Lane, where the solid impurities corresponded to 147 lbs. per acre." The relation of smoke to light is shown in Diagram No. 2, where the black column indicates the soot deposit, and the light column shows the corresponding daylight.

Industrial v. Domestic Smoke.

Upon the moot question as to whether factory smoke or domestic smoke is the greater sinner of the two, the following observations are of interest:

It is sometimes stated that it is the domestic smoke rather than industrial smoke which is injurious to plant life, on account of its higher content of tar. There is a certain amount of justification for this statement, for the percentage of tarry matter in the total solid impurities is highest in the residential and lowest in the industrial areas, varying from 18 per cent. in the former to 4 per cent. in the latter. When, however, account is taken of the total tarry matter deposited each year, the industrial centres are responsible for the greater quantity, which reaches in some cases ten times the amount in the residential districts. The total sulphur, either as sulphurous or sulphuric acid, is everywhere high, but particularly in and near the chief manufacturing areas.

In the discussion which followed upon the paper, Professor Smithells wondered if Professor Cohen had got any nearer to a correct estimate of the relative contaminating effects of the two classes of chimneys. For himself, he could not doubt the evidence of his own senses. Let them notice what happened in a town like Leeds on a Sunday, or late Saturday. At such times there was a great clarification of the atmosphere. It seemed to him that industrial smoke was the chief cause of impurity; but before they charged the manufacturers with responsibility, it was important to get a correct estimate of the manufacturers' share of the blame.

Fog.

It is also a matter of some doubt as to what extent fogs are affected by smoke; but it can hardly be doubted that it is the sulphurous acid that gives to town fog its choky and irritating effects. "The large amount of this acid present in fogs may be gauged from the fact that the hoar frost collected during the dense fog of Jan. 27 last contained acid corresponding to 10·29 parts per 100,000, or more than ten times the average acidity of the same station."

Effect upon Vegetation.

The detrimental effect of sulphuric acid upon vegetation was demonstrated by experiments made upon some boxes of Timothy grass. One sample was watered with Garforth rain water, the acidity of which had been neutralized; another sample with ordinary Garforth rain water; and a third sample with Leeds rain water. In the last case, germination was distinctly checked, and the delicate green of the young grass quickly changed to yellow or brown.

The effect of chlorides must also be prejudicial to vegetation. They are particularly found in industrial centres, where, expressed as common salt, they reach as much as 3 or 4 cwt. per acre. Nitrogenous impurities, on the other hand, would, of course, be beneficial in one way or another.

In conclusion, sufficient has been said to indicate the scope and value of the Leeds experiments, and to justify Mr. Brackenbury's plea for such work to be systematically undertaken in other towns.

On Sept. 21, 1859, Messrs. Thomas Glover and Co., Limited, sold to a Mr. Harwood, of Boston (Lincs.), a 200-light meter, which was fixed in Boston Stump. On visiting this celebrated old church recently, it was discovered that the meter was still working satisfactorily; having completed fifty years of service.

CASE-HARDENING BY GASES.

At a Meeting of the American Institute of Chemical Engineers held recently at Brooklyn, a paper containing the results of experiments on case-hardening by gases was submitted by Mr. J. C. Olsen and Mr. J. S. Weiffenback. The following abstract of the paper is taken from the "Engineering Review."

The older methods of case-hardening consisted of heating the iron in contact with a great variety of solid material invariably containing carbon in large amount, and, in smaller amount, nitrogen and, at times, alkaline substances. Charred organic material was generally used, such as wood charcoal or burnt leather; the latter being advantageous because of its high nitrogen content. Such matter is invariably alkaline, from the decomposition of the alkaline salts originally present in the vegetable fibres. Potassium cyanide has also been used. This salt contains the alkali, carbon, and nitrogen.

Recently the use of gases instead of the solid carbonaceous material has been introduced, and processes of this kind are commercially now employed; but the authors said they could find no published record of experiments conducted to ascertain the relative efficiencies of the various carbon gases. The investigation was undertaken to study this question, and also to ascertain what chemical reactions take place when the carbon from a given gas enters the steel.

The temperature at which the case-hardening must be carried out has been pretty closely determined by previous workers—*i.e.*, from about 700° to 900° C., or 1300° to 1700° Fahr. It has also been ascertained that if the case-hardening is carried out with gases subjected to a certain amount of pressure, the action is much more rapid. This was to be expected, inasmuch as the carbonaceous material is in this manner concentrated in the vicinity of the surface of the steel—this being the only place where action can take place.

The following gases were used in the experiments: Illuminating gas, methane, carbon monoxide, and acetylene. The actual case-hardening experiments were carried out on samples of soft Norway iron containing only 0·08 per cent. of carbon. This iron was purchased in rods 1 centimetre in diameter, which were cut up into 6-inch lengths. A common gas-pipe was used for the case-hardening. It was heated in an ordinary combustion furnace; the temperature of 1500° Fahr. being maintained throughout the experiment. The results were as in the following table:

Gas Used.	Hours.	Hardness.	Depth of Case.	Carbon Composition.
			Mm.	Per Cent.
Illuminating—				
NH_4OH (*a*) . .	4	Glass	1/10	0·57
NH_4OH (*b*) . .	4	,,	2/30	0·665
NH_4OH (*c*) . .	4	,,	2/30	0·915
NH_4OH (*a*) . .	8	,,	3/10	1·12
NH_4OH (*b*) . .	8	,,	3/10	1·16
NH_4OH (*c*) . .	8	,,	3/10	1·15
$CO\ NH_4OH$ . . .	4	,,	4/10	1·45
CO	4	,,	4/10	1·36
CH_4NH_4OH . . .	4	Little hardness	Not well defined	0·32
CH_4	4	,, ,,	,, ,, ,,	0·26
$CH\ NH_4OH$ . . .	4	Glass	3/10	0·98
C_2H_2	4	Little hardness	Not well defined	0·41

Experiments were carried out with each gas alone and mixed with a definite amount of ammonia gas. It was found that ammonia gas facilitates the case-hardening in all instances except that of carbon monoxide, which seems to act almost as well without as with ammonia. Of the three gases studied, the carbonizing ability is in the following order: Carbon monoxide, acetylene, methane. Carbon monoxide, therefore, is by far the best gas for the purpose, as no ammonia seems necessary, and it gives the best penetration in the same time.

FLICKER PHOTOMETER AND THE EYE.

In the "JOURNAL" for the 16th inst. (p. 464), an epitome was given of a paper read by Mr. J. S. Dow, B.Sc., before the Physical Society, on "The Physiological Principles underlying the Flicker Photometer." The current number of the "Chemical News" contains an abstract of the paper, followed by a report of the remarks to which it gave rise. From the latter, we extract the portions of special interest to our readers.

Dr. EDRIDGE GREEN said he was prepared to agree with the effects described by the author, though he thought that they were capable of explanation by another theory. The theory of Von Kries was relied on because the rods contained visual purple while the cones did not.

Mr. A. P. TROTTER, after referring to the doubtful value of the flicker photometer for industrial purposes, said the present investigation should be considered as a scientific one. In discussing the effect of varying the distance of the photometer from the eye, Mr. Dow was really dealing with the angle subtended or the angle of the field of view; and it would be better to use this method of expressing the relation, for it could then be referred to definite parts of the retina. Sir William Abney and others had mapped the areas of the retina, and had found boundaries of colour perception. He considered the angles subtended at the centre of curvature of the retina, and his smallest boundary lay within about 15° from the centre, or, according to usual convention, a field of view of about 30°. The whole of Mr. Dow's present experiments fell well within this, and did not extend to the peripheral parts of the retina. For the purpose of investigating the action of the peripheral parts of the retina, a photometrical device covering a large field of view should be used, and the middle part should be blocked out.

Dr. RUSSELL suggested that possibly mechanical vibrations were set up in the rods and cones of the eye. These oscillations having probably different periods might explain some of the curious phenomena Mr. Dow had shown to the meeting. The cones in the eye did not satisfy the mathematical definition of a cone, and it would be extremely difficult to make any calculations. He was not convinced the rods were unable to perceive colour.

Mr. CLIFFORD C. PATERSON expressed his great interest in the paper, and appreciation of the experimental skill shown by the author. He wished to make some observations upon the so-called yellow-spot effect, because while being able to offer no well substantiated theory to account for the phenomena which Mr. Dow had observed, he could not altogether make the application of the rod-and-cone theory in this instance agree with the experimental facts. He did not think that, in making comparisons, the area of the retina outside the yellow spot was used to any appreciable extent. All who were in the habit of using photometers were probably conscious that if they kept the eye fixed, only a small area of the illuminated surfaces was being considered by the observer at one moment, and the sensation from the outlying area of the surface had no appreciable weight compared with that from the centre, on to which the eye was directed. He (Mr. Paterson) was inclined to believe that many of the discrepancies of photometrical comparisons were due as much to psychological as to physiological causes, even if they were not due more to the former than to the latter. He did not see why the retina should be regarded as the only faulty link in the chain. In the latter portion of the paper, in which the flicker question was discussed, the author showed the observed facts to be very well explained by the theory of the rods and cones; and he (Mr. Paterson) could congratulate him on the flicker experiment he had shown.

Mr. DOW, replying to Dr. Edridge Green's remarks, said he quite recognized that the theory of the action of the retina was a matter for physiologists to deal with. His suggestions regarding the flicker photometer were intended to bring the phenomena into line with the other well-authenticated physiological effects which the rod-and-cone theory had served to explain so completely. Mr. Trotter had offered a suggestion regarding expressing results in angles subtended at the eye, which was a good one. In leaving the results in their present form, he (Mr. Dow) had merely wished to give an idea of conditions occurring in an actual photometer. For experimental purposes, however, it was often desirable to use a larger retinal area. Mr. Trotter's proposal that the centre part of the retina should be blocked out was diametrically opposite to the view of M. Blondel, who had suggested using only the centre part of the retina, where cones only exist. As a principle in photometry, however, it seemed desirable in practice not to depart further from the condition of the eye than could be avoided. In reply to Mr. Paterson, he might say that in viewing a coloured surface he was not conscious of any want of uniformity in brightness due to retinal peculiarities. The eye seemed to weigh up the appearance as a whole, just as in the case of white light. No doubt psychological influences played some part in all these problems. However, the existence of the yellow spot and the Purkinje effects had been known for a long time, and both had been authenticated by many observers. It was only the explanation that still seemed a matter for conjecture.

The adjourned discussion on Mr. H. A. Humphrey's paper, on "An Internal Combustion Pump and Other Applications of a New Principle"—see last "JOURNAL," p. 536—will be taken at an extra meeting of the Institution of Mechanical Engineers next Friday, at 8 p.m.

We learn from the Engineering Supplement to "The Times" that an interesting example of charcoal gas-producer plant has just been completed by Grices' Gas-Engine Company, Limited, Carnoustie, for shipment to Madras. It comprises an engine developing 120 B.H.P. and charcoal plant in duplicate. The engine developed its maximum load for six hours on a fuel consumption of 1·25 lbs. of English charcoal per B.H.P. The design is intended for use in countries where little coal exists, and where charcoal is the staple fuel. The plant is designed to gasify this fuel—supplying a good clean gas to the engine without any more trouble than if good Welsh anthracite were employed. Owing to the low calorific value of charcoal, very much larger generators and feeding hoppers are required. The light nature of the fuel demands special attention in combustion; and a washing-box is employed to trap the considerable amount of dust which is drawn over with the gas from the generator. The gases then pass along to the cooler free from every particle of grit or dust. Sometimes, with imperfectly prepared charcoal, a quantity of tar remains; and to prevent the trouble this may cause in the valves of the engine, a special tar-extractor is fitted.

LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.

A Meeting of the Association, which was largely attended, took place last Friday evening at the Cripplegate Institute, Golden Lane, E.C.—Mr. W. J. LIBERTY, the President, in the chair. The principal item on the *agenda* was a paper describing the system adopted by the Tottenham and Edmonton Gas Company for cleaning gas-cookers, &c., by sand-blast, particulars and illustrations of which appeared in the "JOURNAL" for May 4 last, p. 295.

Mr. W. WRIGHT, of the Tottenham and Edmonton Gas Company, was the author of the paper.

CLEANING GAS-COOKERS BY A NEW PROCESS.

Every year one sees a large increase in the output of gas-cookers. At Tottenham, there are over 19,000 in use, most of which are on hire; and naturally there are always a number of these cookers being brought in to be cleaned and overhauled. The question of how to renovate, thoroughly clean, and turn out equal to a new cooker, with little labour and at a low cost, is a most important item, and the system adopted at Tottenham with this in view is as follows.

When a complaint comes in from a consumer that the gas-cooker is out of order and wants changing, a work card is made out "See to Cooker." About a dozen of these jobs are given to a stove-fitter, who is provided with a bicycle fitted with a carrier to take his tools and spares for the cookers. By this means, about twelve stoves per day can be attended to on the consumers' premises, so saving the expense of their being brought into the stove-shops for cleaning. Should any stove be found in too dirty a condition to be put right at the consumer's house, the work card is marked "Stove to be Changed;" and eventually it is brought away, and replaced by another. As a rule, no cooker is changed unless the consumer has had it for five years in continuous use. There are, however, constantly a number of tenants who remove from one part of the district to another. The cookers left by them are disconnected and brought into the stove-shops to undergo a thorough cleaning before being sent out to another house.

As soon as the cooker arrives at the stove-cleaning shops, it is stripped of all the brass taps and wood-work. The top bars, burners, grids, &c., are put inside the oven, so that identically the same parts shall be used with it again. The stove is then pushed into a large fire-brick oven or muffle, which is capable of holding over a dozen. This chamber is heated by a producer-gas furnace up to a temperature of about 1200° Fahr. In about half or three-quarters of an hour, all the grease and dirt, &c., is absolutely burnt up to a fine dust; and should any cooker have been in a house where any infectious disease has occurred, the disease germs are by this means very effectively destroyed. The stoves are then drawn out by means of long iron hooks, and stood on one side to cool, and another batch of dirty stoves put in to be similarly roasted. When the stoves are cold enough to handle, they are ready to undergo a most novel process of cleaning. Formerly, they were scraped and brushed down by steel brushes, and a most tedious and unhealthy job it was. But now this is a thing of the past. The London Emery Works Company have installed a sand-blast plant for cleaning these cookers; and after a six months' trial, it has proved a remarkable success. The plant consists of a vertical air-compressor, an air-receiver, a sand-blast apparatus, a cleaning room containing a table on which the cooker to be cleaned is placed, a cyclone for collecting the fine sand, and an exhauster which draws away the dust from the cleaning chamber—the whole machinery being driven by a gas-engine.

The operations of the sand-blast plant are as follows. Air is pumped by the compressor into a steel cylindrical tank, 6 ft. 6 in. high by 3 ft. 6 in. in diameter, which is fitted with a safety-valve at the top. From here the compressed air passes along a 2-inch pipe to the two-compressor apparatus, which produces the sand-blast. This apparatus is a cast-iron vessel consisting of two chambers, the top one having a $\frac{1}{8}$-inch mesh sieve, through which the sand passes into the hopper. It has also a cone-valve, which can be opened to deliver the sand to the lower mixing chamber. At the outlet of this chamber is a regulated steel plate, having a $\frac{3}{8}$-inch hole in the centre, through which the sand falls. A length of 2-inch special rubber hose is connected just below this plate, and at the other end of the hose is a specially hardened cast-iron nozzle, with $\frac{3}{8}$-inch bore. A pressure-gauge is fixed on the air-supply pipe to the sand-blast apparatus. We usually work at a pressure of 1·2 atmospheres (about 18 lbs. per square inch).

The cleaning chamber consists of a match-board chamber; and this is lined with sheet-iron to prevent the wood-work from being damaged by the blast. Inside this chamber is an iron turntable 4 feet in diameter, the top of which is fitted with eight cast-iron grids, through which the used sand falls. Underneath the table is a spiral conveyor, which draws the sand to the other end of the chamber to a bucket elevator, which carries up the sand to a slide-back into the hopper of the sand-blast apparatus to be used over again. The top of the chamber is of glass, which affords a good light on the stove to be cleaned. A sliding door, containing a window through which the operator watches the progress of the blast, is in the front of the cleaning room. The dust created in the operation is drawn away by a powerful exhauster; and most of the fine sand is collected in a sack which is fitted on the outlet of the cyclone dust separator. The very fine dust which passes the cyclone is caught in a brick chamber, in which are a number of baffles made of cocoa-nut matting.

The new process of cleaning may be summarized as follows. The cooker, having cooled down, is put on the turntable in the cleaning chamber. The sliding door is closed, and the operator then inserts the nozzle through a slit in the rubber which is in the centre of the door. The blast is turned on, and its effects on the stove watched by the operator through the window. As soon as one side is finished, the table is turned round by a winch and another side of the stove is operated upon; and so on until the whole stove is finished, which operation takes fifteen to twenty minutes. The effect of the sand-blast on the castings is marvellous; the appearance being of a silver-grey, and much smoother than a new casting. The hot plate is then done in the same manner. The small parts—the burners, deflectors, bars, &c.—take longer to treat in bulk, as a considerable time is taken up in properly placing them on the table, as, owing to the lightness of these articles, if they are not packed properly, they are likely to be blown off the table down into the conveyor. Again, these parts are usually much more corroded and burnt, and take a longer time to completely remove the hard scale on them. The result, however, is wonderful. An old burner is brought up to a splendid pitch, equal to a brand new one. The holes of it are thoroughly scoured out; and also the inside of the tube, as well as the outside, is splendidly cleaned. It was absolutely impossible to do this with the use of steel wire brushes; the holes having to be rimed out. It was found when using steel grit that the operations were quicker, but the cost did not warrant continuance of its use.

As soon as the small parts have been sand-blasted, they are treated by the "Bower-Barff" process, which is done by placing them in an ordinary fire-clay retort 22 in. by 16 in., heated up to a temperature of about 1300° Fahr. Steam is then let in at the mouthpiece of the retort, which immediately becomes superheated; the result being that a coating of magnetic oxide is formed on these parts. After being in this retort for half-an-hour, they are drawn out and allowed to cool. These burners, &c., are now rust-proof, and present a very pleasing appearance. They are then taken into the fitting shops quite ready to be fixed up on to the cookers. About twelve complete cookers per day are turned out in this manner, and are quite equal to, if not better than, brand new stoves.

The advantages of cookers being treated by the sand-blast plant are many. One particular item is that the breakages of small parts are now not a quarter of what they used to be. In the old-fashioned way of chipping and scraping by hand, we were always having a lot of burners, deflectors, &c., broken; but now with any casting it can be seen directly at a glance whether it is suitable to be replaced on the stove or not, without chipping so as to find this out ultimately. Another point is that there are no holes to rimer out in the boiling and oven burners; the sand-blast cleans out the holes exactly as though they had been redrilled. Again, the cooker bodies to be revarnished do not take nearly so long to do, as the surface of the casting is so smooth and perfectly clean, and less varnish is used than heretofore. The hot plates—and particularly the planed edges—can be burnished up in a quarter of the time after receiving the sand-blast by being put on the emery bobs.

It will be clearly seen from the remarks I have made that the cookers are cleaned up to perfection. This fact is borne out by many leading gas engineers who have come from all parts of the country, also America and the Continent, to see this sand-blast plant; and all who have seen the dirty cookers sand-blasted have been astonished with the results after treatment. I have no doubt that before long many other gas companies will adopt this up-to-date method of cleaning, not only gas-cookers, but all kinds of goods, such as brass main-cocks, wrought-iron fittings, and service-pipes, which can be done in a very short space of time. Already one large gas company is having a big plant installed by the firm who put up ours at Tottenham. I may add that we are having another larger chamber and turntable installed—the grids of the latter specially made to hold the smaller parts as desired. This will enable us to cope with about 25 stoves per day with two operators.

I give you a few figures comparing the cost of methods, but can add finally that appearance goes a long way, and in hiring gas-stoves it is impossible for the uninitiated to tell the difference between a new and an old sand-blasted, Bower-Barffed, properly cleaned cooker as turned out at our establishment. With regard to cost, the following table is based on ten hours' working:—

Cost by Hand Work.	s.	d.	*Cost by Sand-Blast Plant.*	s.	d.
Three men at 6d. per hour	15	0	Gas for engine	3	0
Two boys at 3d. per hour	5	0	One man at 6d. per hour	5	0
Steel scrapers, wipers, emery cloth, steel wire brushes	1	0	One man at 6½d. per hour	5	5
			Oil	0	3
			Cast-iron nozzles	0	4
			Sand, 2 cwt., at 6d.	1	0
				15	0
			Less sand sold, 2 cwt., at 10d.	1	8
Total	21	0	Total	13	4

It will be seen that a saving of about 7s. 6d. per day is effected by using the sand-blast process.

Discussion.

Mr. J. R. GALE (Mill Hill) asked whether all the stoves brought in had to be treated in the same way, irrespective of whether or not they were very dirty.

Mr. WRIGHT: All cookers go through the same process.

Mr. GALE (continuing) remarked that, on the question of cost, the author did not say what was the outlay in the first instance; and he did not, in his comparison, make any allowance for this. In the hand process of treatment there would not, of course, be any similar plant required.

Mr. S. A. CARPENTER (Mill Hill) thought the plant was one of the first of its kind to be used in this connection. They, however, looked to Tottenham for initiative; and it was only natural they should find one of the earliest plants there. Those who had had anything to do with the cleaning of gas-stoves, could appreciate the practical nature of the paper. It was his privilege some time ago to see the plant at Tottenham, though unfortunately it was not running; but he was much impressed with Mr. Wright's keenness, and the great interest he took in everything connected with the installation. He did not altogether follow the author's figures in the calculation he had made showing a saving of 7s. 6d. a day; and he thought if they had the cost of cleaning per stove both by the old and the new methods, it would be most useful for comparison. Of course, too, the cost of the plant, as had already been mentioned, was an important point, because with the older method a tank was practically all the apparatus required. The oven and sand-blast apparatus must require considerable outlay. He gathered that the author considered it was much more efficient than the older plan, which, he took it, was just an oven, and then the stoves were gone over with steel brushes. Did Mr. Wright find the new method quicker? He understood it was cheaper and more efficient, and supposed it would be quicker; but he would like to hear about this. There were two points that greatly struck him. With regard to the enamel linings, it had been stated, he believed, that the action of the sand-blast ruined these; so he took it that when a cooker was subjected to this cleaning process all the enamel parts would have to be renewed. An even more important point, however, to his mind, was that the sand-blast would not touch the soft grease. Most cookers had soft grease on them; and if they could not be cleaned in this condition, it seemed the process could only have a limited application. He would like to hear whether Mr. Wright had tried shot; and, if so, how it compared with sand. What little experience he himself had had in cooker cleaning, had been with the old wet process—just boiling the dirty cookers in caustic soda solution, which was most simple. He could not at the moment see any marked superiority in the method they had just had described to them over this older plan. They had to put the stove in the oven to burn off the grease; and then they had to transfer it to the sand-blast apparatus. His first impression was that under the new system they did not have to take the stove to pieces; but so far as he could gather now, this had to be done to the same extent as with the tank. They had to renew the linings; and they must take the stove to pieces to do this. And if the stove had been through the oven, he trembled to think what a job it would be to get the bolts and screws out. It was bad enough before they had been burnt. Did Mr. Wright consider that this process cleansed the cookers to the same extent as, for instance, caustic soda? There was no possibility of any grease remaining after they had been boiled; and it seemed to him that there was a chance of grease remaining in the cookers which could not be reached by the sand-blast. There was one other point. Perhaps it did not quite come under the heading of the paper; but it would be interesting to know what conditions were imposed by the Tottenham Company as to changing cookers. Would they change them when required by a consumer; and was any charge made for doing so? He made these critical remarks with considerable humility, because they knew that what Tottenham had done had been after much careful thought. No doubt Mr. Wright would deal satisfactorily with his queries; but at the same time he did not believe that the sand-blast treatment was the final word in cooker cleaning. What they needed was a method by which a stove could be cleaned in one process, without taking to pieces. It was the taking to pieces and putting together again which ran up the cost.

The PRESIDENT pointed out that the author had stated how long it took to clean a stove by the new process; and he thought it would be interesting to know how this compared with the old method. Then he noticed there was a reference to the Bower-Barff system. He himself had some experience with a Bower-Barff Company some thirty years ago; and he would much like to know whether this was the same. The concern he knew was the Bower-Barff Rustless Iron Company. Iron was treated with a solution which prevented it from ever rusting, no matter what exposure it was subjected to. Would a stove ever get rusty again after treatment by the process the author referred to?

Mr. K. SPROXTON said he did not propose to aim any criticisms at the author, because previous speakers had referred to the points most likely to arise. He had had the good fortune to see this plant under Mr. Wright's guidance; and he came away with the feeling that that gentleman knew all that there was to be known about it. When visiting the plant, he was reminded very strongly of the ancient quest of the alchemists. They used to spend their lives looking for three principal things—the philosopher's stone, the elixir of life, and a universal solvent. It was recorded that they spent many years trying to find something that would dissolve everything; but at last someone asked the question, "If we find this solution, what vessel is to hold it?" It seemed to him that if this sand-blast plant had one drawback with its operation, it was that the blast was so powerful that it gave trouble even in the machine which produced it. No doubt, the Tottenham people had made experiments, and were gradually overcoming this perplexing problem, and would finally succeed in doing so. He felt sure that these pioneers in North London deserved the best thanks of the profession for having introduced such a powerful scourer, whose only fault was that it began its work, as it were, before it was born. It was interesting to meet the example of pre-natal energy which they had in this plant.

Mr. F. AINSWORTH (Ilford) asked how many of the cookers treated were packed, and how many were not packed; and the cost of dealing with each kind. Did the placing in the hot oven entirely remove the grease? He supposed the sand-blast was intended to clean the cookers and give them a new appearance. As to the cleaning of the taps, he did not gather that any particular method was mentioned. If the enamel linings were in good order, did they remove them before the stove was put in the oven? The question of cost was important. He remembered visiting one works, and was very pleased with the method adopted for cleaning the cookers there; but he was told that the outlay on plant was something like £2000. Of course, this was going to add to the cost of cleaning. He would like to know the cost of the sand-blast plant, &c., at Tottenham, so that they could see what had to be added to the labour and material required in the operation of cleaning. When they went in for an expensive plant, he took it that the idea was not only to obtain a good finish, but to reduce the cost of the work. They must have a good finish. There was no doubt that cleaned stoves must be turned out like new; otherwise considerable trouble would arise which should be avoided. With his Company, the rule was that a cooker should be in use six years; but, of course, discretion was used. Every place should have a limit of time for cookers to be out. Then he would like to ask whether any liquid at all was used in the cleaning operations. At one place to which he went he had been given to understand that the oven method had been tried, and then the tank plan, with soda, was reverted to.

Mr. A. L. ARNOULD remarked that he had been struck by the fact that they had to employ the two processes of first baking and then sand-blasting; and he was wondering while the paper was being read whether it would be possible (or whether such a thing had been tried), by having a steam-blast, to do the two things in one. That was to say, whether a steam-sand-blasting would take the grease off and do the cleaning at the same time.

Mr. F. W. WEDD inquired whether, when the brass taps were sand-blasted, there was any trouble from the sand getting in and interfering with the working of the plugs. Also, was there any appreciable wear in the sand-blasting process? Did it remove an appreciable thickness of metal as well as the dirt?

Mr. J. HEWETT said it appeared to him that the ring-burners were simply taken off and baked.

Mr. WRIGHT: Yes.

Mr. HEWETT (continuing) asked in what condition they emerged from the process; and also whether the sand-blast could be got right into the inside of the tubes of these burners. It was not always grease that got inside. Very often a vessel boiled over; and the gas and air way was liable to become choked up with something that mere baking would not tend to remove, but rather to harden.

Mr. A. BROADBENT said that, with reference to the effect of the sand-blast treatment on the enamel linings, it struck him that some of the stoves at present delivered in London were treated with enamelling of the castings themselves. What process would they subject these to?

Mr. WRIGHT, replying to the discussion, said the plant cost from £200 to £250; and, of course, they must allow something for depreciation, repairs. and interest on capital This would amount to (say) 2s. 6d., which would have to be deducted from the 7s. 6d., thus leaving a saving of somewhere about 5s. a day. The material used for the sand-blast plant was sea sand, which he put at 6d. per cwt.; and when they had worked the sand up, it had a marketable value of about 10d. per cwt. so that in reality it cost them nothing. They had tried steel shot; but owing to the exhauster being so powerful it was drawn into the exhaust pipe, and carried away. As they lost a good deal in this manner, they gave it up. The cost of the shot was about £8 per ton; so that there was a considerable difference in this respect. The stoves were not taken to pieces at all at Tottenham. Everything went inside the muffle except the wooden knob, which would be quickly burnt up, and the brass rail and taps, which went into the pickling tank. The stove remained in the oven, at a temperature of some 1200° Fahr., for about three-quarters of an hour; and by that time every particle of grease, matches, fish-bones, mice, and anything else, was absolutely burnt up to a fine dust. He would defy anyone to find even the merest speck of grease on any part of the stove, after it had been in the oven for the time he had mentioned, and was red-hot from top to bottom. They did about a dozen at a time—some packed, and some unpacked. Those with linings went in as well. As to the questions about stoves that had enamelled parts, he might say that these were placed in the pickling tank. They did not put more enamels into the oven than they could help. They had made it a rule that a stove must be in the consumer's hands for five years before they changed it; but, of course, they used a

little discretion. If a consumer demanded a fresh stove after a short period of use, a fitter on a bicycle, with the necessary appliances, visited the house; and perhaps in a very little time the stove was put right. The Company had two of these stove fitters, each with his own district.

Mr. AINSWORTH: In such a case, what is the charge, if you must change a stove?

Mr. WRIGHT said there was no charge for changing after five years; but after a shorter period, they would charge 5s. It was astonishing how many people had never heard of the Bower-Barff process. There was no patent about it. The idea was brought out by Professor Barff thirty or forty years ago; and then Mr. Bower came along, and they formed a Company. But someh ow the thing went wrong. The South Metropolitan Company adopted the process; and the Engineer of his own Company was struck by it. The system was therefore tried at Tottenham, and very fine effects were obtained. A burner, bar, or grid treated by this process was absolutely rustless. They treated a sheet-iron shelf and hung it out in the yard for about eighteen months; and not a particle of rust appeared on it. There was no smell; and it was better than a lot of paint. Most of their stoves were packed; it was only the free cookers that were unpacked. As to the cost of dealing with the two, he would not like to speak off-hand. When the stoves cooled down after being ed hot, grease, &c., was reduced to fine powder; and directly they went into the sand blast, this dust could be seen absolutely blown off in two or three seconds. Taps were not sand-blasted at all. They were put into the caustic soda tank to remove grease. The taps were all opened, so that the soda should run through; and then they were allowed to drain, and were polished up. The plugs were kept in the taps; they were not taken to pieces at all. The sand blast must not be applied to the enamelled parts of stoves. The cooker was always put in the chamber with the door on. They did the whole of the outside; but when the stove was turned over to sand-blast the base and legs all round, care had to be taken not to touch the enamelled parts. As to the wear on the metal, of course it would take a long time to blast a hole in a cast-iron stove. It might be done in a week, if the nozzle were kept on one spot. The cast-iron grids of the turntable it was stated would last two years; but after ten months' use they were getting very thin, through the constant application of the sand-blast. They were about an inch thick. Of course, there was a certain amount of wear; but it must be remembered that the nozzle was not kept in one place. When parts that had been treated with the Bower-Barff process came in again, all that it was necessary to do was to dip them in the caustic soda. It was not requisite to put them through the process a second time.

Mr. WRIGHT then exhibited a series of about eighty lantern slides illustrating parts of the Tottenham Gas-Works, different makes of gas cookers, fires, geysers, meters, governors, examples of high-pressure lighting, personal photographs, &c.

Mr. SPROXTON subsequently proposed a hearty vote of thanks to Mr. Wright for his paper and the pictures he had shown.

Mr. E. SCEARS (Hampton Wick) seconded; and remarked that they would look forward with great interest to seeing the apparatus that had been described when they visited Tottenham. He did not gather that there would be very great economy in the introduction of this process, except in the case of a large company.

Mr. L. F. TOOTH, in supporting the vote, said it seemed to him that the question as to whether the process was good, bad, or indifferent could only be determined by time—for this reason: Baking a stove must naturally deteriorate it more quickly than the old method of boiling; and then, as had been said, the sand-blast also deteriorated the cooker. The point that time would have to settle was whether the saving in the cost of cleaning would more than cover the extra amount of depreciation. Everyone in the gas industry who had any dealings with cookers was watching carefully to see what the result would be.

The resolution was heartily carried.

Mr. WRIGHT, in acknowledgment, said the sand-blast plant was not at the gas-works, which the members were to visit next Saturday (Dec. 4); but Mr. A. E. Broadberry, the Engineer, had said that if any of them cared to go to No. 639, High Road, Tottenham, between 2 and 2.30 that afternoon (before going to the gas-works), they should see the apparatus at work.

The PRESIDENT, in closing the meeting, said that quite recently 20 new members had joined the Association; and he wished if possible to signalize his second year of office by bringing the total membership up to 200. This meant 60 more recruits; and he appealed specially to those gas-works outside the Metropolis which the Association had not yet touched at all, and where there was much scope for obtaining members. Many of the seniors had expressed the hope that their juniors would join the Association; and in view of this, he intended to enter on a little campaign. That night they had two new members present from as far away as Reading.

In the House of Commons on the 16th of June last, returns were ordered to be prepared relating to all the authorized gas undertakings in the United Kingdom—in the case of the Companies, for the year ended Dec. 31, 1908, and in that of the Local Authorities for the year ended the 31st of March last—in continuation of previous Parliamentary Papers. The returns have now been presented, and ordered to be printed.

EFFECT OF OXYGEN IN COAL.

In a bulletin by Mr. David White, published by the United States Geological Survey, giving the results of a comparative study of ultimate coal analysis, the author maintains that the elimination of oxygen in the preparation of coal for fuel is economically far more important than has been generally suspected, and that the oxygen is very nearly as harmful as ash. The conclusions drawn from this comparative study are summed up in "Engineering Record" as follows.

Coals with high oxygen and low ash will, in general, have very nearly the same efficiency in the calorimeter as other coals with alternated percentages, low oxygen and high ash, if the total carbon is the same. This applies to both air-dried and moisture-free coals. Oxygen and ash are of very nearly equal anti-calorific or negative value; ash being probably slightly more injurious in most coals. The negative value of the oxygen of moisture is not far different from that of the oxygen combined in the coal.

The calorific value of coals in general is essentially indicated by the balance between the total carbon on the one hand and the sum of the two great impurities, oxygen and ash, on the other; the hydrogen, nitrogen, and sulphur being usually negligible as constants. Except in the presence of unusual variations of hydrogen or sulphur, the efficiencies of the coals, if ash be constant, rank nearly in the order of the ratio of carbon to oxygen, which in each kind of coals marks the progress of coal formation under dynamo-chemical influences. Oxygen and ash being of approximately equal anti-calorific potency, the efficiency of the coals conforms fairly closely to the order of the ratio of carbon to oxygen *plus* ash; so that among coals of all kinds those having the same ratios have about the same efficiency.

A miscellaneous series of coals of all kinds, ages, and regions, when plotted according to the carbon to oxygen *plus* ash ratios and calorific values as components, describes a curve to which they conform very closely; the average variation being less than 1 per cent. of the calorific value. The greatest variations are among weathered coals—those having 79 per cent. or more of fixed carbon in pure coal (that is, those undergoing anthracitization)—and the boghead cannel group, in which the hydrogen is excessively high, so that the efficiencies describe a higher curve, characteristic of the group.

The departures from the radio-efficiency curve, on account of unusually high or low available hydrogen, are generally not large. High sulphur is usually attended and compensated by high hydrogen; the converse being true to a less extent. Unusually high sulphur acts, on the whole, as a diluent; while very low sulphur leaves the relative field to the heat-determining elements. Consequently, the variations from the curve on account of the neglected constants—hydrogen, sulphur, and nitrogen—are rarely more than 2 per cent., unless in the exceptions noted in the preceding paragraph.

Types of coals are initially determined by the nature of the ingredient matter, the conditions of deposition, and the extent of operation of the first or biochemical process in coal making; but progressive devolatilization, lithification, cleavage, and other accompanying alterations, result from the second or dynamo-chemical stage of coal formation, which in each kind removes the essential distinctions of age or region, even tending ultimately to obliterate the differences in kind. Consequently, any classification of coals based on the present form of ultimate analysis must be arbitrarily defined. There is intergradation in all parts of the process of coal conversion and coal alteration, as well as in the ingredient matter and conditions of deposition.

The weathering of the lower grades of coal, especially the lignites, bituminous coals, and peats, is marked by accession of oxygen, which is taken into combination. This increase of the oxygen content, which seems to indicate lack of equilibrium in the hydrocarbon compounds of the normal coal, readily permits a calorific deficiency, which, on account of the high anti-calorific value of oxygen, is often serious. It is possible that in many cases considerable increase of oxygen and consequent loss of efficiency are suffered by lower-class fuels between their removal from the bed and their deposit in the grate or the chemical crucible.

The adaptability of a coal to coking by the ordinary process appears to be indicated with a fair degree of certainty by the ratio of the hydrogen to the oxygen moisture-free basis. Practically all coals with hydrogen-oxygen ratios of 59 per cent. or over seem to possess the quality of fusion and swelling necessary to good coking. Most coals with ratios down to 55 per cent. will make coke of some kind; while a few coals with ratios as low as 50 per cent. will make coke in beehive ovens, though rarely producing a good article. The coking property seems to depend not so much on the amount of available hydrogen as on the relative amount of the hydrogen as compared to that of the oxygen. In coals undergoing change to anthracite, the hydrogen-oxygen ratio may fail as a guide. The failures appear, however, to be readily distinguished by the marked calorific deficiencies shown by the carbon to oxygen *plus* ash ratio and efficiency curve.

The data examined, though insufficient to serve as a basis for a conclusion, seem to point towards the need of a relatively high carbon element in the remaining volatile combustible of coals with 79 per cent. or more of fixed carbon (pure coal), in order to secure either the best coking results or the calorific efficiency indicated by the carbon to oxygen *plus* ash ratio-efficiency curve.

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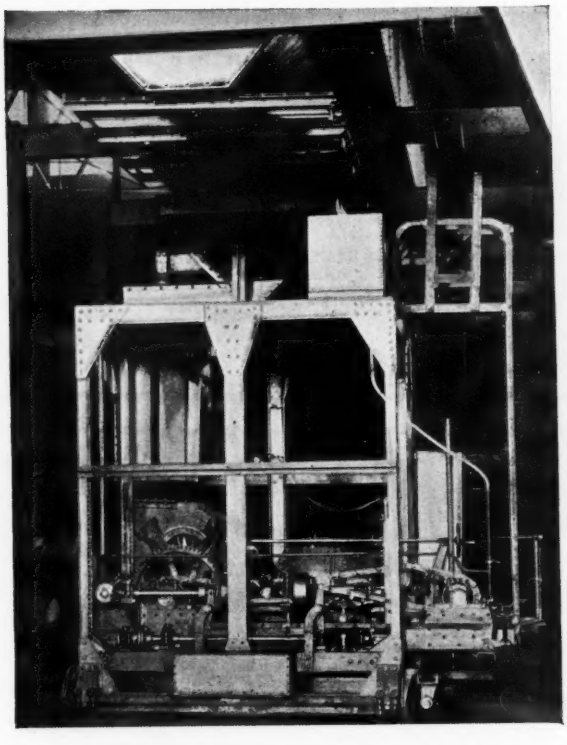

STIRLING RETORT-HOUSE.

See "JOURNAL," Aug. 3, 1909, Page 309.

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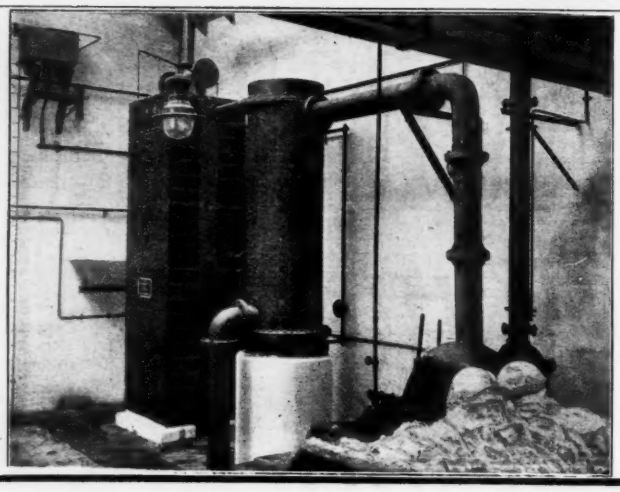

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REGISTER OF PATENTS.

Purification of Gas.

CHANDLER, S., of Brixton Hill, S.W.

No. 27,841; Dec. 22, 1908.

This gas-washing device is fully described and illustrated in earlier columns of to-day's issue, p. 594.

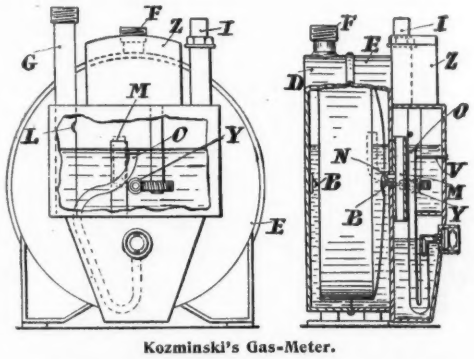
Gas-Meters.

KOZMINSKI, S., of Charlottenburg, near Berlin.

No. 4262; Feb. 20, 1909.

This invention relates to wet gas-meters in which light mineral oil—of the nature of solar oil, spindle oil, and the like—is employed as the sealing liquid. The light, non-freezing mineral oil, free from paraffin, which is employed is on the dividing line between petroleum and the light lubricating oil distillate—namely, oil of the viscosity (according to Engler) of 1·2 to 2 at 20° C. Such light mineral oils, the patentee points out, do not freeze at the lowest temperatures which occur in practice, and are such thin liquids that the gas pressure is not diminished to a greater extent by the motion of the drum than in the case of other liquids. The oils, too, are not changed by the gas, either physically or chemically; and they do not attack the gas in any manner. They neither dry up nor do they contain acids; they do not resinify, nor can they become rancid, which is the case with vegetable oils. Also they do not attack the materials of the case and drum, so that these metal parts may be made much lighter and thinner than heretofore. Of special importance, however, is the property these oils possess, in that they do not evaporate at all, nor do they diminish in volume. After gas has passed through for a very short time, the volume of the oil becomes perfectly constant, so that no physical or chemical changes at all take place in the oils when the gas is continued to be passed through them. This state of equilibrium occurs in spindle oil (for example) after it has absorbed 2·3 to 2·7 per cent. by weight of illuminating gas; and in the case of solar oil, after it has absorbed 1·7 to 2 per cent. by weight. As soon as these small quantities are absorbed by the oil the state of equilibrium occurs, and then "measurements are obtained of an accuracy which has never been obtained heretofore, and almost all supervision or refilling of the sealing liquid is done away with."

On account of the property of the liquid, that it does not vary in volume during a long period, it is also possible to do away with the floating valve employed in wet meters heretofore, "which only serves the purpose of limiting the fall in level of the liquid up to a certain point."



Kozminski's Gas-Meter.

The drum shown is of the usual construction, except that the metal is less than 0·35 mm. thick, "which is possible owing to the exceedingly small dimensions of the drum, both in diameter and in breadth." Owing to this light weight, a thin, steel needle B suffices as an axle, and makes the running of the drum very light. The axle is provided inside the front box with a worm Y, which imparts the motion of the drum by worm wheel to the counting mechanism enclosed in the box Z. The drum is enclosed in a case consisting of two halves D and E, which are divided by a joint running around the exterior of the case and connected by a narrow roll-shaped ring. In consequence of the small breadth of the drum, the outer case can be made correspondingly narrow; but in order to be able to employ the meter for pipe-line connections with the standard distance between the connecting sockets, the inlet pipe G is not located (as customary) at the rear of the front box, but is placed at the front end of it. The second pipe connection F—*i.e.*, the gas delivery pipe—is arranged at the rear of the case. The case is filled by the inlet closed by the screw I (which may be removed only by a special key) with the thin liquid mineral oil already referred to.

In the example shown, there is no floating valve. The gas enters through G, passes through the hole L in the front box, without passing a floating valve, into the gas-pipe M, whence it passes through the bent pipe N into the interior of the drum.

In order to avoid some of the sealing liquid flowing away through the gas-supply pipe M when the pressure fluctuates on the main stop-cock being opened and closed, a special relatively narrow liquid level adjusting pipe O is arranged, so that when the level fluctuates only the small quantity of liquid which this pipe can still hold enters the pipe. At the same time the pipe M is so arranged that its mouth is somewhat higher than the pipe O, so that the fluctuations in level of the liquid cannot reach the pipe M. The bottom end of this pipe is connected with the vessel P for receiving any overflow liquid.

Before the meter is started working, it may be adjusted by a wire V soldered to the pipe O and passing through a hole in the wall of the front box, so that when it is moved it moves the flexible tube O. When the adjustment is finished, the wire is soldered to the wall of the box and the hole in same is closed.

Incandescent Gas-Mantles.

RHENANIA GLUHLICHT COMPAGNIE (G.m.b.H.), of Cologne.

No. 5010; March 1, 1909. Date claimed under International Convention, Feb. 6, 1909.

This invention relates to soft incandescent mantles, which it has been proposed previously to secure to the ring supporting them by a string drawn through the upper meshes of the mantle and tightened in the groove of the ring intended to receive the string, and the ends then tied into a knot. To secure mantles to rings of various diameters and of various shapes without any binding or tying, the patentees propose to provide at the open end of the mantle an extensible closed securing ring—preferably consisting of a smooth extensible cord of rubber, metal, or other suitable material, surrounded with asbestos or some other refractory material. The ring may be corrugated, spiral, or of plain formation; and, in using the mantle, it is pushed over the supporting ring until the elastic ring engages with the groove of the supporting ring. Thus any special binding or tying is avoided.

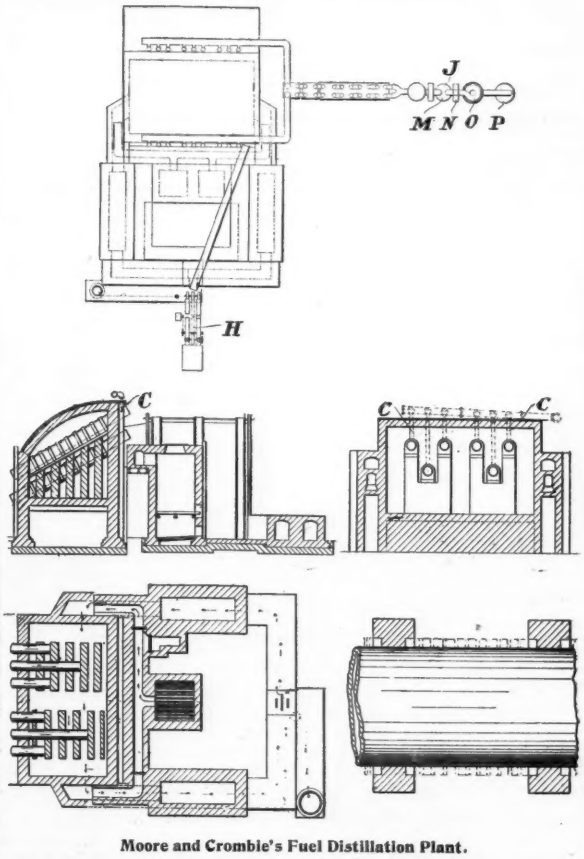
Treating Fuel and Recovering Bye-Products.

MOORE, W. G., of Birmingham, and CROMBIE, W. A. E., of Forest Hill, S.E.

No. 6966; Sept. 30, 1909.

This invention has for its object "to extract and reclaim more of the volatile matter from the fuel than hitherto possible, and at the same time to leave in the retorts carbon of a high degree of purity."

In apparatus of the class to which the invention relates, it has been previously proposed to cause the gases, after issuing from the retort, to traverse a condenser before entering the pump; but by the present invention the contents of the retort are subjected to the influence of a practically complete vacuum (as referred to in Simpson's patent No. 7732, of 1906). After issuing from the pump, the gases may be passed to a compressor and subsequently treated for the "reclamation" of an additional quantity of benzol. The retorts employed have "a new form of sectionally assembled refractory covering, according to which new form the sections of fire-brick, fire-clay, or other material are retained and adapted to entirely encase the metal retort."



Moore and Crombie's Fuel Distillation Plant.

The diagrammatic plan of the plant is accompanied by a sectional elevation of the retort chamber and regenerators, a sectional plan and elevation, and an enlarged view of the rebated blocks hereafter described.

It is proposed to erect a retort-chamber of suitable dimensions for the size and number of retorts required. The retorts may be taper, parallel, or any appropriate shape, and made from any suitable material, but preferably round, and from mild steel or wrought iron. They are provided externally with fire-bricks or rebated blocks with recesses to accommodate an "advantageously perforated covering," whereby the metal pipes are protected from oxidation and the dele-

terious effect of direct contact with the flame. The retorts may be placed horizontal or otherwise, but preferably at an angle of, or above, 40°. To allow the gases to pass unimpeded through the retorts, perforated tubes are placed in them; while each end of the retorts is formed by rebated blocks, and preferably the top ends of the retorts or perforated tubes (when incorporated) are connected with pipes coupled to a nearly horizontal main pipe for conveying the crude gas and bye-products to the condensing and collecting portion of the plant. The retort-chamber is advantageously heated by producer gas and regenerated air.

The fuel is preferably charged into the retorts as follows: An elevator H raises the fuel up to a suitable height, and a swing adjustable shoot conveys it from the elevator into the retorts, where the fuel is so heated as to give out its volatile matter; and these gases are conveyed by pipes and treated as described below, while, by the practically complete vacuum of (say) 25 inches, for drawing the gases from the retort and aspirating them from it immediately they are evolved and before they are broken up into permanent gases, it is found that the "volatile matter is more easily split up into elements which are treated chemically with greater facility than heretofore by reason of their not having been subjected to an excessive temperature in the retort."

The gaseous or liquid products pass from the retorts to the vacuum pump J through a series of condensers—first air-cooled then water-cooled—each connected with catch-pots by which the more condensible vapours are fractionally separated, and the tar and heavier liquors are prevented from passing through the pump. A supplementary condenser may be provided through which the fluids pass before proceeding to the pump.

The pump then discharges the remaining gases and liquids at about the surrounding temperature into a receiver M, and the remaining vapours and gas are then greatly reduced in temperature to condense out as much as possible of the benzol and other vapours. These may be collected in a catch-pot, and the gases passing thence are utilized or stored. If desired, the gases, after discharge from the pump J, may be passed to a compressor N, and thence allowed to traverse a coil O and impinge upon perforated plates fixed in a metal box P for the purpose of obtaining an additional quantity of benzol. The gases may then be conveyed to a storage vessel, or utilized for combustion in the retort-chamber and other purposes.

When the distillation is complete, the connecting pipes are closed; the retort is opened up and discharged; and the carbon is immediately cooled by water or lime water, or is taken off hot and used as fuel at once or converted by heat and suitable treatment into other forms of carbon.

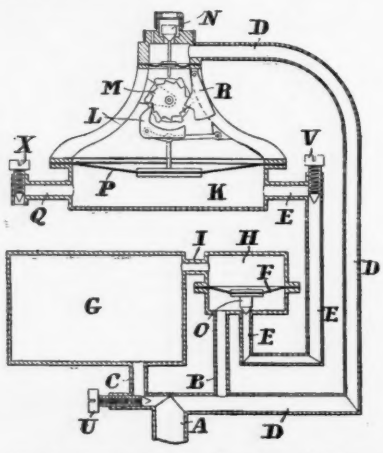
Controlling Gas-Burners from a Distance.

ROSSBACH-ROUSSET, F., of Templehof, near Berlin.

No. 8855; April 14, 1909. Date claimed under International Convention, May 26, 1908.

This invention relates to apparatus for controlling from a distance the valves of gas-burners—particularly lighting burners of the type wherein a temporary increase of pressure causes a yielding member to admit gas to the burner.

The auxiliary pressure member employed is in the form of a diaphragm, and is normally exposed to equal gas pressure on both sides. The auxiliary diaphragm carries a valve, which is opened when the pressure of gas is increased in the mains, but closes again as soon as the pressure has been balanced on both sides. The apparatus, it is said, overcomes the disadvantages experienced in previous constructions, since no liquid is employed and the auxiliary pressure member is exposed to an equal pressure of gas on both sides; "whereas the floats hitherto used have either normally been exposed to different pressures or to the pressure of the atmosphere on either side."



Rossbach-Rousset's Gas-Burner Controller.

In the arrangement of the apparatus for use with upright burners, the gas passes by the pipe A, through the pipe B, to the under-surface of the auxiliary diaphragm F. At the same time it flows through the throttle U by the pipe C into a gas-collecting chamber G, and thence, by the pipe I, into the space H above the auxiliary diaphragm. The gas further passes unimpeded through the pipe D to the burner-valve N. Moreover, when the valve O, controlled by the auxiliary diaphragm, is opened, gas passes through the throttle V by the pipe E to the under-surface of the main diaphragm P, the upper surface of which is open to the atmosphere. After entering the casing K of the main diaphragm, the gas escapes through the outlet pipe Q controlled by a throttle X, which only permits the gas to escape very gradually into the atmosphere.

Under normal day or evening pressures (when any appreciable fluctuations take place gradually), there is the same pressure both above and below the auxiliary diaphragm. It is, therefore, depressed by its weight and presses the valve O against its seat, whereby the admission of gas to the working diaphragm P is shut off. This main diaphragm is therefore in its lowest position, as both above and below it there is the pressure of the atmosphere, since the casing K is in communication with the atmosphere by the pipe Q. When the various parts occupy these positions, the valve-actuating mechanism is ready to open the valve.

When the valve is to be opened, the pressure in the mains is raised as quickly as possible to an extent corresponding to the load on the auxiliary diaphragm F. This increase of the pressure is at once transmitted to the under-surface of the auxiliary diaphragm, and raises it, because the short time is insufficient for the transmission of the increase of pressure to the space H above the diaphragm, owing to the narrow pipes C, I, and (more particularly) the gas-collecting chamber G. The length of time required for equalizing the pressure on both sides of the auxiliary diaphragm is varied by the adjustable throttle U in the pipe C.

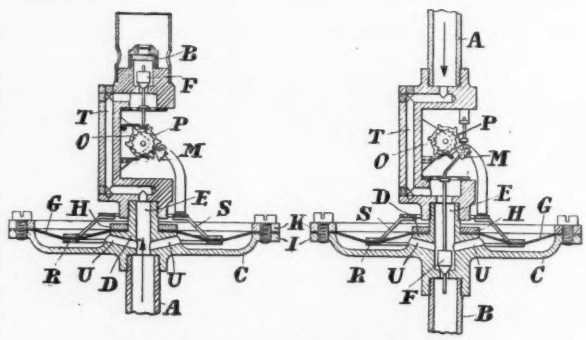
The raising of the auxiliary diaphragm opens the valve O. Gas passes then to the under-surface of the main diaphragm P more quickly than it can escape into the atmosphere, owing to the throttle X in the pipe Q, but only as quickly as is permitted by the position of the throttle V in the pipe E. The main diaphraghm P is slowly raised, and effects (by means of the mechanism M, L, R) the movement of the gas-valve N; so that the latter is either opened or closed. After the pressures above and below the diaphragm F have become equalized, the main diaphragm P sinks again as the valve O closes the gas supply, and the gas escapes from the casing K through the branch Q. Both the diaphragms F and P are again exposed to equal pressure on both sides; and the valve is again ready for the next movement imparted to it.

Controlling from a Distance the Valves of Gas-Burners.

ROSSBACH-ROUSSET, F., of Tempelhof, near Berlin.

No. 8856; April 14, 1909. Date claimed under International Convention, April 16, 1908.

This invention relates to apparatus for controlling from a distance the valves of gas-burners of the type wherein, on a temporary increase in the pressure taking place, a diaphragm is moved so that ratchet mechanism is actuated to open or close the valve supplying gas to the burner. For this purpose, gas must be supplied both to the burner-valve and also to a chamber below the diaphragm on which the valve-operating mechanism is carried.



Rossbach-Rousset's Gas-Burner Valve Controller.

The illustration shows a longitudinal section through the device for incandescent gas-burners having upright mantles (the ratchet mechanism being outside the gas-chamber); also a corresponding view of the device adapted for inverted burners. The ratchet mechanism may in both cases be fitted in the gas-chamber.

In both constructions a cup-like casing C is secured to the inlet gas supply pipe A or B respectively. It is provided in its centre with a branch D, the longitudinal bore E of which is in open communication with the pipe A. Further, the conduit can be connected to the burner-pipe B by the gas-supply valve F. The diaphragm G, which, on the pressure being changed, actuates the gas-valve F, is of annular shape, and secured at its inner circumference to the branch D, in which it is, for instance, fixed between the branch and an annular disc H secured to it. At its outer circumference, the diaphragm G is preferably secured between the flange I of the casing C and a cover or ring K secured to the latter.

The movements of the diaphragm are transmitted by ratchet mechanism M, O, P to the gas-valve F. To that end, in the centre between the edges of the diaphragm, a narrow ring R is secured, provided with a bracket S on which is mounted the pawl M of the ratchet. The ring also is used for carrying the weights (not shown) required for adjusting the device.

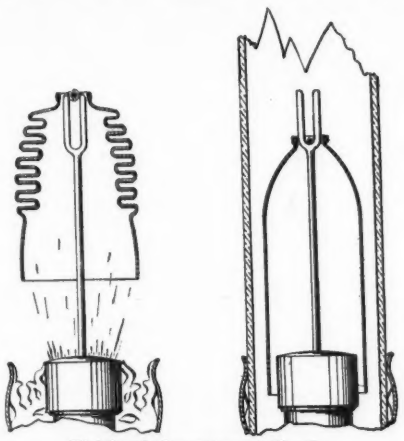
In the constructions shown (wherein the ratchet mechanism is arranged outside the gas-chamber), it is necessary to connect the gas-supply pipe A to the burner-pipe B by means of a pipe T, which is, according to this invention, disposed inside the casing surrounding the gas-valve F, the ratchet mechanism M, O, P, and the diaphragm G; so that any formation of naphthalene in the pipe or freezing are avoided. The gas passes through the bore E of the branch D and the pipe T to the valve F, and also through the conduits U, branching off from the bore E, under the diaphragm G; so that when the pressure changes, the valve F is either opened or closed.

Incandescent Gas Lighting Bodies.

WEICKERT, M., of Plauen, Saxony.

No. 10,745; May 6, 1909.

Patent No. 2572 of 1908 described a "method of burning-off unshellaced and uncalcined incandescence mantles on the burner, by means of an elongated fork, so as to afford to the asbestos eye of the mantle the freedom of motion which is necessary for obtaining a sufficiently long mantle, in view of the shrinkage caused by the calcination." It has been found, however, that, after the burning of the mantle, the lower part of the incandescence body obtained by the calcination of the mantle is not sufficiently hardened, and, consequently, is liable to break during the motion of the lamp, or through other mechanical shocks. The present invention has for its object to avoid these defects.



Weickert's Incandescent Mantle.

For this purpose, the asbestos eye of the mantle is enclosed in a sleeve of aluminium—preferably in the shape of a coil—which melts only in the heat of the flame, after the lamp cylinder has been mounted in its place. The width of the coil is such that it will be held fast in the upper end of the fork. Moreover, the mantle is considerably shortened before being mounted on the burner, by the formation of zig-zag folds in the fabric, similar to those of a concertina.

The illustration shows the folded mantle mounted on the burner before being incinerated or burnt; and the same mantle after incineration.

APPLICATIONS FOR LETTERS PATENT.

26,425.—HIBBERD, C. E., "Gas-meters." Nov. 15.
26,428.—JONES, A. O., "Treatment of gases from coke-ovens or gas-retorts." Nov. 15.
26,432.—PUDNEY, F., and SADLER, F., "Mantles." Nov. 15.
26,459.—WHITE, M., "Gas-generating apparatus." Nov. 15.
26,513.—GILLIE, W. S., "Pressure-raising apparatus for air or gas." Nov. 16.
26,545.—TIERNAN, J., and GOLDBERG, A., "Collar and special pipe-end for making a faucet joint on gas, water, or other pipes." Nov. 16.
26,561.—SMITH, W. P., "Incandescent burner." Nov. 16.
26,624.—ROBILLOT, L., "Automatically actuating an alarm signal in cases of escape of gas." Nov. 16.
26,640.—MIDDLETON, S. H., "Gas taps or cocks." Nov. 17.
26,660.—HALLIWELL, F., and R. & J. DEMPSTER, LTD., "Tanks for gasholders." Nov. 17.
26,702.—HANZER, C. & P., "Lighting and extinguishing burners." Nov. 17.
26,719.—WILLIAMS, J., "Carburetting air." Nov. 17.
26,730.—CALLOWAY, E., "Taps or cocks." Nov. 17.
26,749.—SOUTHEY, A. W., "Generation of gas." Nov. 18.
26,797.—LAWRANCE, W., "Incandescent burners." Nov. 18.
26,843.—ANDERSON, D., "Lamps." Nov. 18.
26,858.—STEWART, J. & W., "Gas-producers." Nov. 19.
26,859.—BOYS, C. V., "Pumping water." Nov. 19.
26,873.—STEVENSON, A. H., "Mantle boxes." Nov. 19.
26,942.—PEARSON, J., "Attachment to money-box for prepayment meters." Nov. 19.
26,964.—DEMPSTER, R., AND SONS, LTD., and TOOGOOD, H. J., "Gasholders." Nov. 20.
26,990.—TWIGG, W. W., and MOORE, G., "Gas-taps." Nov. 20.
26,993-4.—CROSSLEY, K. I., and RIGBY, T., "Internal-combustion engines." Nov. 20.

Rochdale Corporation Gas Workers' Wages.—At their meeting last Wednesday, the Gas and Electricity Committee of the Rochdale Corporation had again under consideration the application of various classes of employees at the gas-works for an increase in wages. Some time ago, the Works Sub-Committee recommended that the wages of the labourers be advanced 1s. 6d. per week, this to include holiday pay, and that certain others be granted an increase of 1s. and 2s. per week, according to the character of work done by them; but that no advance be conceded to the stokers and meter inspectors. These recommendations were referred back by the General Committee. Having reconsidered the matter, the Sub-Committee now recommended that a Joint Committee, representative of the various Committees employing labourers, be appointed to go into the whole subject, with a view to securing a uniformity of policy. After a long discussion, the General Committee last Wednesday, by eight votes to six, approved the suggestion of the Sub-Committee for the appointment of a Joint Committee, and rejected an amendment to the effect that the gas-works labourers be granted an immediate advance to 25s. weekly.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Proper Allowance for Depreciation of Gas Plant for Income-Tax Purposes.

SIR,—I have read Mr. William Cash's letter, published in your last issue, with very great interest, having constantly to deal with the public companies principally concerned, for poor-rate purposes.

In my judgment, the circular issued by the Board of Inland Revenue condemns itself by meting out different treatment to gas companies and electric light undertakings, thus:

GAS AND WATER UNDERTAKINGS.

18. No depreciation should be allowed in any circumstances in respect of any portion of these undertakings.

19. All expenditure on repairs and renewals, but excluding extensions and improvements, is to be charged and allowed as working expenses, as and when incurred.

ELECTRIC LIGHTING UNDERTAKINGS.

Cables.

21. In addition to repairs, allowance for depreciation may be granted at the rate of 3 per cent. per annum on the written-down value.

Plant and Machinery.

22. On all other plant, exclusive of loose tools, meters, and office furniture, depreciation may be allowed at the rate of 5 per cent. per annum on the written-down value, in addition to the cost of repairs.

I cannot find any justification for this difference of treatment, which is, of course, aggravated by the fact that gas companies and electric light undertakings are trade competitors.

If it is urged that electric lighting undertakings are much younger than gas-works, and that therefore their renewals have not reached the average level, I reply that the same remark applies to the particular portions of the gas companies' undertakings as to which Mr. Cash so strongly argues that an allowance should be made for depreciation. Everybody connected with gas companies knows that the supply of stoves, slot-meters, and fittings, has been undertaken by the gas companies within the life of electric lighting undertakings, and that not only do they require a depreciation allowance because they have not reached the normal expenditure, but there is the additional point to be considered that the supply of these articles has been in the nature of an experiment.

It seems to me also that the fact that slot-meters and stoves can now be bought at considerably lower prices than those ruling originally, has a bearing on the case. If the companies are only to be allowed the actual cost of renewals as they arise, they will have lost the difference between the original cost of the articles and what they can now be purchased for.

In my opinion, however, the gas companies' strongest point is that there is no reason for allowing electric lighting undertakings depreciation in addition to repairs, which does not equally apply to a considerable portion of the gas companies' plant.

49/50, *Parliament Street, S.W., Nov.* 26, 1909. A. L. RYDE.

Fatality in Islington.—Last Saturday morning, three little girls, the daughters of a man named Turner, who with his family occupied the basement of a house in Stonefield Street, Barnsbury, were poisoned, as is supposed, by inhaling coal gas. It appears that after breakfast both parents left the house—the man in search of a job, the woman to do a day's work—the three girls remaining in bed in the front room of the basement, apparently safe. Later in the morning, it is stated, other occupants of the house, as well as of the one adjoining, detected a strong smell of gas, and messages were dispatched to the Gas Company requesting that they would send men to look into the matter. About twelve o'clock, a little girl, daughter of an upstairs resident, passed down the area steps, and afterwards, it is said, spoke to her mother about the strange appearance of the little girls below. This led to an investigation of the lower rooms, which resulted in the discovery of the three children in what appeared to be an unconscious condition. Medical men and the police were at once summoned; but it was found that the two younger children were dead. There were some signs of life in the eldest, and every endeavour was made to save the child; but she shortly afterwards died.

Exmouth Water Scheme.—The opponents of the scheme proposed by the Exmouth District Council for augmenting the water supply of the town are not losing any opportunity of putting forward their case. Last Tuesday they called a public meeting at which the arguments against the present proposals were stated once more by the members of the Council who have voted against them. The Rev. O. J. Reichel, who has led the opposition, contended that the Dotton scheme would cost £40,000, and that this sum, added to the existing debt, would be a serious burden for Exmouth. Mr. J. Carter urged that other means should be taken to provide a supply of water; and he advocated boring operations near the present filter-beds. Though this was prohibited by the Council's Acts of Parliament, he was quite of opinion that the Lord of the Manor would not take action to prevent the Council obtaining water from this place. Several other members of the Council and ratepayers spoke against the Dotton scheme. An amendment was proposed in favour of this proposal; and it was supported by the argument that a large sum of money has been spent upon the scheme, and that if it were again defeated heavy expenditure would fall on the town without contributing to the solution of the difficulty respecting the water supply. This, however, found practically no support; and a resolution calling upon the Council to drop the Dotton scheme was carried.

PARLIAMENTARY INTELLIGENCE.

NOTICES GIVEN FOR BILLS (SESSION 1910) RELATING TO GAS, ELECTRICITY, AND WATER SUPPLY.

Abertillery and District Water Board.—Authority will be sought for the constitution and incorporation of a Joint Water Board, with power to construct an impounding reservoir, aqueducts, and other works in the counties of Brecknock and Monmouth. The existing works of the Abertillery, Abercarn, and Risca Urban District Councils are to be vested in the proposed Board; but power is sought to enable the Risca Council, in the event of their not joining in the promotion of the Bill, to become a constituent authority. The limits of supply will be defined in the Bill, which will contain the usual water provisions, as well as others relating to the creation of stock and the borrowing of money.

Ammanford Gas.—Application will be made by the Ammanford Gas Company for an extension of their limits of supply as defined in the Act of the present session, so as to include the whole or parts of the parishes of Llanedy and Bettws, in the county of Carmarthen; and also for authority to enter into an agreement with the Great Western Railway Company for the construction of a siding at Tirydail, and to purchase lands at this place and in the parish of Llandebie and erect gas-works thereon. Provision will be made in the Bill that the purchase price or award to be paid for the undertaking of the Amman Valley Gas Company, Limited, may be paid by debentures, preference shares, or other securities of the Ammanford Company; and the latter Company wish to be empowered to take proceedings to ascertain the validity of the debentures of the Amman Valley Company, and to declare invalid all debentures or shares issued without payment in money—the expenses to be deducted from the purchase price of the undertaking.

Bishop's Stortford, Harlow, and Epping Gas and Electricity.—Authority will be sought for the amalgamation of the Bishop's Stortford, Harlow and Sawbridgeworth, and Epping Gas Companies, for the vesting in the Company so constituted of the undertakings of the Ongar, Newport (Essex), and Much Hadham Gas Companies, and for the purchase of the undertaking of the Dunmow Gas Company, Limited. The capital is to be defined and increased. Power will be required to supply gas and electricity, maintain and extend gas-works and erect generating stations, deal in gas and electric stoves, &c. The Bill will contain the usual provisions incidental to the manufacture and supply of gas and electricity, the pressure and testing of gas, and the regulation of pipes and fittings.

Bradford Corporation.—A General Bill to be promoted by the Bradford Corporation will contain a clause empowering them to purchase by agreement the private gas-works belonging to the Trustees of the late Sir Henry William Ripley. The Corporation will also seek authority to hold certain lands for the purposes of their water undertaking, or for protecting from fouling and pollution, the waters they are empowered to appropriate. It is proposed to define the expression "domestic purposes," and make various provisions as to the supply of water. Additional borrowing powers are required.

Brighton and Hove Gas.—In a Bill for which notice has been given by the Brighton and Hove Gas Company, provision will be made with reference to the use and disposal of certain lands; the issue of authorized capital, and the reduction of capital; the holding of the half-yearly meetings; dealing in stoves, machinery, and appliances; the exemption of fittings, &c., from distress; and the inspection and regulation of pipes and fittings. The Company wish for authority to make further provisions in regard to the pressure and quality of gas and the method and place of testing it.

Bristol Gas.—The Bristol Gas Company will apply for authority to raise additional capital, create a special purposes fund, redeem the existing debenture stock, and issue new stock of this character in substitution. The Company wish to be relieved from penalties for sulphur impurities. The Bill will alter the prescribed illuminating power of the gas, fix a uniform power for the whole undertaking, make new provisions with respect to the apparatus for, and mode of, testing, and define the conditions under which the Company are to be liable to penalties for deficiency. The Company will ask to be enabled, where pipes or fittings are calculated to allow of the escape of gas, or meters are liable to become incapable of registering correctly, to require the consumers to alter the position of their meters or to provide new ones, and in default of compliance with such requirements to cut off the supply and recover the expenses with any other moneys due from the consumer. Among the other provisions of the Bill will be one to the effect that fixed engines, &c., are to remain the property of the Company, and others dealing with the qualification of Directors, the appointment of a Managing-Director, and the mode of fixing the salary of the Secretary.

Cambridge Water.—Application will be made by the Cambridge University and Town Water Company to be empowered to sterilize or otherwise treat the water supplied by them, and construct additional works, comprising two wells and pumping-stations in the parish of Fulbourn, another in the parish of Cherryhinton, a reservoir in that parish, and two adits and two pipe-lines in connection therewith. Confirmation will be sought for the purchase of the lands and premises now belonging to the Company; and authority will be asked to increase, alter, and impose additional rates. Further capital and borrowing powers will be required.

Chipping Norton Gas and Electricity.—The sanction of Parliament will be sought for the incorporation of a company for the supply of gas and electricity in the borough of Chipping Norton and the parishes of Over Norton and Great Rollright. It is proposed to purchase, by compulsion or agreement, so much of the undertakings of the Mid-Oxfordshire Gas Company and the Chipping Norton and District Electric Light and Power Company as is situated in the borough or is connected therewith. The proposed company will ask for authority to erect and maintain gas-works and an electricity generating station on certain lands defined, levy and recover rates and charges, and make agreements with local authorities,

Clevedon Water.—The Urban District Council of Clevedon will apply for authority to purchase, by compulsion or agreement, the undertaking of the Clevedon Water Company, maintain and continue the existing works, and supply water within the urban district of Clevedon and the parishes of Tickenham and Kenn and part of the parish of Walton-in-Gordano, in the rural district of Long Ashton, in the county of Somerset, or within such other limits as may be prescribed by the intended Act. Borrowing powers will be required.

East Grinstead Gas and Water.—The East Grinstead Gas and Water Company will apply for the confirmation of their Hackenden works, and for authority to construct others, consisting of a well and pumping-station in the parish of Forest Row, in the rural district of East Grinstead, a service reservoir at the latter place, a water-tower, and three aqueducts or pipe-lines; also to acquire by agreement the well and works at Place Land. The Bill will contain provisions in regard to the protection of the Company's works and supply, and to the sale of water to or by adjoining authorities, companies, and others. Additional capital and borrowing powers will be required.

Egremont Urban District Council (Gas).—Authority will be applied for by the Egremont Urban District Council to manufacture gas, supply it in the urban district of Egremont and adjoining parishes, and acquire the undertaking of the Egremont Gas Company, for which an agreement has already been entered into. It is proposed to ask for the repeal of the provisions of the Cleator Moor Local Board Gas Act, 1892, in pursuance of which the Cleator Moor Urban District Council now supply gas within the urban district of Egremont. The promoters of the Bill wish for authority to acquire, by compulsion, or agreement, certain gas mains and plant of the Cleator Moor Council and of the Whitehaven Rural District Council, and to continue, maintain, and renew the existing gas-works and to construct others. The Bill will contain provisions in regard to the sale of gas in bulk and for power, the supply of meters, fittings, and apparatus, testing the quality of the gas, and the levying of rates and charges. Permission will be sought to apply existing funds for purposes of the undertaking; and an enlargement of the present borrowing powers will be sought.

Exmouth Gas.—The Exmouth Gas Company will seek authority to extend their limits of supply so as to include the parishes of Lympstone and Woodbury, in the rural district of St. Thomas. The Bill will contain provisions in regard to the price and quality of gas; and the reduction of its illuminating power will be applied for. The present capital is to be converted and consolidated, and power to raise more, to form a special purposes fund, and to make further provision for the payment of dividends under the sliding-scale, will be sought.

Exmouth Urban District Council.—Authority will be sought by the Exmouth Urban District Council for the construction of additional water-works consisting of a well and pumping-station in the parish of Colaton Raleigh, and two aqueducts, conduits, or pipe-lines, both commencing at the pumping-station, and one terminating in the River Otter, and the other at the Squabmoor reservoir in the parish of East Budleigh. Permission will be required to apply the Council's existing funds and to borrow more money for the purpose set forth.

Farnham Gas and Electricity.—Application will be made for the dissolution of the Farnham Gas Company, Limited, and the incorporation of a new company to carry on the undertaking, with power to supply both gas and electricity. Authority will be sought to maintain the existing gas-works and construct others, as well as a generating station and works for the supply of electricity. It is proposed to define and increase the capital, and form reserve and special purposes funds. The Bill will contain provisions in regard to the pressure and testing of gas, and also those incidental to the supply of gas and electricity. The Farnham Electric Lighting Order, 1905, is to be repealed.

Fylde Water Board.—The Fylde Water Board wish to be authorized to construct additional works, consisting of a covered service reservoir and a water-tower in the borough of Blackpool, an equilibrium basin in the township of Barnacre-with-Bonds, a number of aqueducts or pipe-lines, and a road diversion. The Bill will contain further provisions in regard to the conduct of the undertaking, the borrowing and repayment of money, making the Board's stock a trustee security, suspending payments into the sinking fund, and the appointment of a Secretary to the Board.

Garnant Gas.—Parliamentary sanction will be sought for the incorporation of a company to supply gas in parts of the parishes of Bettws and Llandilofawr Rural, in the county of Carmarthen, part of the parish of Llangwig, in the county of Glamorgan, and adjoining places. Authority will be asked to purchase lands and erect and maintain gas-works thereon; and the general powers conferred in respect of the supply of gas will be required.

Gas Companies (Standard Burner) Bill.—The notice given for this Bill was published in full in the "JOURNAL" last week (p. 548).

Gowerton Gas.—Application will be made by the Gowerton and District Gas Company, Limited, for authority to supply gas within the parishes of Gowerton and Longhor, and elsewhere, in the County of Glamorgan, and within so much of the parish of Llandeilo, Talybont, as is not in the area of the Pontardulais Gas Company, Limited. The Company require power to purchase lands, construct and maintain gas-works, supply fittings, and levy rates and charges.

Great Grimsby Gas.—The Great Grimsby Gas Company intend to apply for an extension of their limits of supply so as to include the whole or parts of the parishes or townships of Ulceby and North and South Killingholme, in the rural district of Glanford Brigg, and of the parishes of Aylesby, Habrough, Healing, Immingham, and Stallingborough, in the rural district of Grimsby, all in the county of Lincoln, and for authority to exercise within the extended limits all the powers conferred by their existing Acts. In the Bill to be promoted, provisions will be included in regard to the raising of additional capital, the formation of special purposes and other funds, the fixing of a standard price for gas, the supply of stoves and other appliances, and the sale of gas in bulk.

Hastings Corporation.—In a General Bill to be promoted by the Hastings Corporation, they will ask for authority to purchase compulsorily the lands upon which their existing pumping-stations and works at Forwood, Crowhurst, and Pebsham have been constructed, also lands adjoining them and at Westfield, and to construct thereon

additional works for improving the water supply to the borough. These comprise three pumping-stations, to be situated respectively in the parishes of Catsfield, Crowhurst, and Bexhill, a service reservoir in the first-named parish, wells and adits, and three conduits or pipe-lines. Further borrowing powers will be required.

Havant Gas and Electricity.—The Havant Gas Company, Limited, desire to be dissolved and re-incorporated with general powers for the supply of gas and electricity in their existing area. The Bill will contain provisions in regard to the capital and borrowing powers of the Company, the maintenance and extension of their gas-works, the manufacture and storage of gas and residual products, the generation and supply of electricity, and the levying of rates and charges.

Hoyland Nether Urban District Council (Gas Purchase).—The Urban District Council of Hoyland Nether, in the West Riding of York, intend to seek authority to supply gas within the township or urban district of Hoyland Nether, the portion of Brampton Bierlow which is not included within the limits of supply defined in the Wath-upon-Dearne and District Gas Order, 1900, part of the township or urban district of Worsbrough, and the parish or township of Tankersley; and also to purchase the undertaking of the Elsecar, Wentworth, and Hoyland Gas Company. Power will be sought to confirm and make all necessary provision for carrying into effect any agreement between the Company and the Council already made, or to be made prior to the passing of the intended Act, for the sale and purchase of the Company's undertaking, and to provide for maintaining and carrying it on until its transfer to the Council. The Bill will contain the usual powers conferred upon gas companies; and provision will be made in it for the winding-up and dissolution of the Company. The Council will apply for authority to borrow money for all or any of the purposes of the intended Act.

Kingswood Water.—Authority is sought for the incorporation of a company with power to supply water within the parish of Kingswood, in the county of Surrey, and to acquire the undertaking of the Kingswood Water Company, Limited. It is proposed to ask for the confirmation of the existing works, situated in the parishes of Reigate and Kingswood, and for authority to construct others, consisting of a pumping-station, a service reservoir, a water-tower, two rising mains, and two pipe-lines. General powers in regard to the supply of water are required, as well as sanction for the raising of capital on the security of the undertaking.

Little Hulton Urban District Council.—The Urban District Council of Little Hulton require authority to supply gas within their district, purchase, by compulsion or agreement, portions of the gas undertakings and plant of the Salford Corporation and the Farnworth and Kearsley Gas Company, and construct new works. They will ask for authority to take a supply of gas in bulk from the Earl of Ellesmere, and for the confirmation of any agreement entered into with him for the supply of gas from the existing coke-ovens on lands in his possession and occupation. The Bill will contain provisions making it obligatory upon the above-named Corporation and Company to supply gas to the Council, in bulk or otherwise, until the completion of the proposed new works, whereupon their rights and obligations will cease. The necessary borrowing powers will be required. The other provisions indicated in the notice will be more fully dealt with when a print of the Bill is available.

Mallow Gas.—Authority will be sought for the dissolution and re-incorporation of the New Mallow Gas Company, Limited, with power to manufacture gas, and supply it in the whole of the urban district, and in certain specified places in the rural district, of Mallow. It is proposed to maintain and extend the existing works, define and increase the capital, and make provisions in regard to the price, quality, pressure, and testing of gas. The Company will ask for power to apply for a Bill or Order to enable them to supply electrical energy.

Mallow Urban District Gas.—The Urban District Council of Mallow will apply for authority to purchase, by compulsion or agreement, the undertaking of the New Mallow Gas Company, Limited; maintain, improve, and extend the existing works; and supply gas in the urban district of Mallow and in parts of the surrounding rural district. The Bill will contain the usual provisions incidental to the supply of gas, as well as for the raising of money for the gas undertaking, and the application of the revenue derived from it.

Maltby and Tickhill Water.—Application will be made for the incorporation of a company with power to supply water in the parish of Maltby, the urban district of Tickhill, and certain other parishes in the West Riding of the county of York.

Maltby Gas.—Authority will be sought for the incorporation of a company for the supply of gas within the parishes or townships of Maltby, Braithwell, Bramley, Hooton Levett, Dinnington, Laughton-en-le-Morthen, Stainton, and Wickersley in the West Riding of York, and for the purchase of land and the erection of gas-works thereon. The general powers granted to a gas company will be required, as well as permission to purchase, by compulsion or agreement, the works and undertaking of any company not possessing statutory powers supplying gas within any part of the above-named parishes.

Matlock Bath and Scarthin Nick Urban District Council.—The Urban District Council of Matlock Bath and Scarthin Nick will apply for the repeal of certain provisions of the Matlock Bath Gas Act, 1895, and the Matlock Bath Improvement Act, 1905, with regard to the removal of the gas-works, and for authority to maintain and improve the works on the present site. They will also ask for some additional powers relating to the supply of gas, such as the construction and placing of pipes and fittings between mains and meters, the allowance of discounts and rebates, and the making of charges for gas taken through prepayment meters.

Middlesbrough Corporation.—In a General Bill of which the Middlesbrough Corporation have given notice, they will apply for further powers with regard to their gas and electricity undertakings. They wish for authority to supply prepayment meters, cookers, and fittings, require consumers to provide anti-fluctuators for gas-engines, regulate the size and material of pipes and fittings, exempt from distress cookers, &c., let on hire, reduce the illuminating power of the gas, and allow discounts on charges. Additional borrowing powers will be required.

Middleton Corporation.—A General Bill for which notice has been given by the Middleton Corporation will contain further provisions concerning their gas and electricity undertakings. They will fix the standard quality of gas, and provide for the better testing of it. They will also ask to be empowered to undertake the free wiring of houses for electric lighting and other purposes, and make such charges therefor as they may fix or as may be prescribed. Authority will be sought for supplying, fixing, repairing, and removing gas and electrical fittings, and for selling electricity in bulk. Permission will be required to raise money for the purposes of the Bill.

Mountain Ash Water.—The Mountain Ash Urban District Council require authority to construct additional works, comprising a reservoir in the parish of Penderyn, an intercepting dam in the same parish, and several aqueducts and other works. Permission will be sought for covering in the Darranlas reservoir. It is proposed to alter the existing rates and charges. Borrowing powers will be required.

Pontypridd and Rhondda Joint Water Board.—Authority will be sought by the Pontypridd and Rhondda Urban District Councils, or one of them, for the constitution and incorporation of a Joint Water Board for the purchase of the undertaking of the Pontypridd Water Company, which it is proposed shall be dissolved and wound up. The Bill will provide for the transfer to the Board of the water undertaking of the Rhondda Council; and extension will be required of the time specified in the Company's Act of the present session for the acquisition of land and the construction of certain works. It will also contain the usual provisions in regard to the supply of water, as well as authority for the borrowing of money.

Pontypridd Water.—The Pontypridd Water Company intend to apply for power to extend the period limited by the Pontypridd Water-Works and Tramroads Act of 1908 for making a substantial commencement with the Llia reservoir and the purchase of lands for the construction of the remaining works authorized by that Act other than the tramroad and works abandoned under the Act of the present session. They also seek power to extend the periods limited by that Act for the compulsory purchase of lands necessary for the construction of the railway, reservoir, and other works authorized by it.

Rhondda Urban District Council.—In a General Bill to be promoted by the Rhondda Urban District Council, they will apply for further powers in respect of their gas undertaking, including authority to prescribe the charges to be made for gas supplied through prepayment meters, and to require any person who has a separate supply of gas for power or other purposes, or of electricity, to pay a minimum charge for gas, and to impose other terms and conditions in connection with such supply.

Salford Corporation.—The Corporation of Salford will apply for various powers in connection with their gas undertaking. They wish for authority to acquire, hold, and use certain lands, called the Earl of Ellesmere's Brick-Works, in Salford, for manufacture and storage of gas. The Bill will contain new or altered provisions with respect to the application of the revenue arising from the gas undertaking and to the allocation of the profits, and others for the amendment or repeal of the portions of the Acts of the Corporation relating to the illuminating power, purity, and testing of gas, and the recovery of moneys. Other provisions will relate to the hire of gas and electric stoves, engines, meters, &c. Authority to raise more money will be required.

Shirebrook Gas.—Application will be made by the Shirebrook and District Gas Company for an extension of their limits of supply so as to include the parishes of Cuckney and Norton, in the county of Nottingham, the remainder of the parish of Warsop not already included in their area of supply as defined by their Act of 1899, and portions of the parish of Bolsover, in the county of Derby. It is proposed to ask for the amendment of the Mansfield Commissioners' Gas Act, 1878, and the Corporation Act of 1901; the repeal of the Corporation's powers of supply in Warsop, and of those of the Bolsover Gas Company in regard to parts of the parish of Bolsover; and the amendment of the Bolsover Gas Order of 1894. Confirmation will be required for any agreement already made or to be hereafter entered into between the applying Company, the Mansfield Corporation, and the Bolsover Gas Company, or any other body, company, or person, in relation to any of the objects of the intended Act; and sanction will be asked for the employment of the existing funds for the purposes indicated.

Slough Water.—The Slough Water Company intend to apply for an extension of their limits so as to include a portion of the parish of Fulmer, for confirmation of their existing works, and for authority to construct others in connection with them. The Bill will contain provisions in regard to the acquisition of lands, springs, and waters, the supply of fittings, the sale of water in bulk, and the levying of rents, rates, and charges. Permission will be sought to apply their funds for the purposes of the intended Act.

Southend Water.—Application will be made by the Southend Water Company for an extension of their limits of supply so as to include the parish of Buttesbury, in the rural district of Chelmsford, for the confirmation of the existing works, and for authority to construct others, comprising no fewer than fourteen pumping-stations. The Bill will contain provisions as to the supply of water beyond the limits, waste of water, making and supplying fittings, maintaining the pipes and apparatus of consumers, &c. Additional capital and borrowing powers will be required.

South Hants Water.—The South Hants Water Company will ask Parliament to sanction and confirm the existing works and the expenditure of capital thereon, and to authorize the purchase of land and the construction of additional works, comprising a covered service reservoir in the parish of West End, another in the parish of Hedge End, both in the rural district of South Stoneham, and five aqueducts or pipe-lines in connection therewith. The Company wish to be empowered to extend their limits of supply so as to include Owslebury, Upham, East Wellow, Dimwood, and Minstead, in the rural districts respectively of Winchester, Droxford, Romsey, and New Forest, in the county of Southampton; and to raise more capital.

South Lincolnshire Water.—Further powers are required by the South Lincolnshire Water Company. They wish to have their limits

extended so as to include the urban district of Holbeach, and to be authorized to raise additional capital, and to issue as preference or preferred ordinary shares any portion of the ordinary capital of the Company sanctioned by their Act of 1906.

Staffordshire Potteries Water.—Application will be made by the Staffordshire Potteries Water Company for authority to construct additional works, comprising a pumping-station in the parish of Eccleshall, another in the parish of Draycott-in-the-Moors, a service reservoir and other works in the parish of Swinnerton, all in the county of Stafford, and five aqueducts or pipe-lines in connection therewith. The Company will also apply for the confirmation of the existing works, and for authority to raise further capital.

Thorne and District Water.—Application will be made for the incorporation of a company with power to supply water within the rural district of Thorne, in the West Riding of York, and in the urban district of Crowle, in Lincolnshire. It is proposed to construct two wells and pumping-stations at Thorne, and one at Crowle, with a water-tower in connection with each, and several conduits or pipe-lines. The Bill will contain provisions in regard to capital.

Tipperary Gas.—Authority will be sought for the dissolution and re-incorporation of the Tipperary Gas Company, Limited, with power to manufacture gas, and supply it in the whole of the urban district, and in certain townlands in the rural district of Tipperary. The general provisions of the Bill will be similar to those of the Mallow Bill already noticed.

Warrington Corporation.—A General Bill for which notice has been given by the Warrington Corporation will contain several provisions in connection with their gas, electricity, and water undertakings. They relate (*inter alia*) to increasing the discounts on gas accounts, the erroneous registration of meters, the conditions under which gas shall be supplied to premises having electricity laid on, free wiring, the supply of electricity in bulk, the charge for gas in and beyond the borough, the framing of bye-laws with respect to pipes and fittings, and the improvement of the water supply. More money will be required.

Wells and Fakenham Water.—Application will be made for the incorporation of a company with power to supply water within the urban district of Wells-next-the-Sea and in the parish of Fakenham and certain other parishes in the county of Norfolk. It is proposed to construct a well, pumping-station, and water-tower in the parish of Sculthorpe, and two conduits or pipe-lines in connection therewith. The capital powers required will be defined in the Bill.

Whitland Water and Gas.—Parliamentary sanction is to be sought for the incorporation of a company for the supply of water and gas in the rural districts of Whitland, in Carmarthenshire and Narberth, in Pembrokeshire, and for the purchase of the undertaking of the Whitland and District Water and Gas Company, Limited. Authority will be required for the construction of water and gas works, and for the usual powers in regard to supply.

Wicklow Gas.—Authority will be sought for the dissolution and re-incorporation of the Wicklow District Gas Company, Limited, with power to manufacture gas, and supply it in the whole of the urban district of Wicklow and in certain townlands in the rural district of Rathdrum, in the county of Wicklow. The general provisions of the Bill will be similar to those of the Mallow Bill already noticed.

Worksop Urban District Council.—Application will be made by the Worksop Urban District Council for authority to purchase the undertaking of the Worksop Water Company. In the Bill to be promoted with this object, the Council will provide for the application to them of the provisions of an agreement, dated the 24th of March last, made between the Company, the Duke of Newcastle, and the Wigan Coal and Iron Company, Limited. Power will be sought to maintain the works and supply water within the Company's limits, make further provisions in regard thereto, levy rates and charges, and raise money for carrying on the undertaking; and the Council will apply for exemption from the enactments limiting the profits arising from the business.

PROVISIONAL ORDER APPLICATIONS (SESSION 1910).

Board of Trade, under Gas and Water Works Facilities Act, 1870.

Barnstaple Water.—The Barnstaple Water Company will apply for an extension of their limits so as to include the parish of Instow, or some part of it. Additional capital will be required.

Brownhills and District Gas.—Application will be made by the Ogley Hay and Brownhills Gas Company, Limited, for authority to maintain and continue their existing works at Walsall Wood, construct and maintain additional works, and manufacture, store, and supply gas and residual products in the parishes of Walsall Wood, Norton-under-Cannock, Ogley Hay, and Shire Oak, all in the urban district of Brownhills; also in the parish of Ogley Hay Rural, in the rural district of Lichfield. The present capital is to be regulated, and authority will be sought to increase it.

Builth Wells Gas.—The Builth Wells Gas Company, Limited, will seek authority to maintain and continue their works, and supply gas in the urban district of Builth Wells and the neighbourhood; also to make provisions in regard to their capital and borrowing powers, the amount of dividend and interest to be paid, and the formation and application of reserve and renewal funds.

Burnham Gas.—Authority will be sought by the Burnham Gas Company, Limited, to maintain, continue, and construct gas-works, and to conduct a gas undertaking in the parish of Burnham, and parts of the parishes of Burnham Without, Brent Knoll, and Berrow, in the county of Somerset. The Order will contain provisions similar to those in the Highbridge Order, noticed later.

Chelsham and Woldingham Water.—Application will be made by the Chelsham and Woldingham Water Company for power to maintain and continue their existing water-works, and supply water in the parishes of Chelsham and Woldingham and parts of the parishes of Oxted, Limpsfield, and Titsey, in the rural district of Godstone, in the county of Surrey.

Chertsey Gas.—The Chertsey Gas Consumers' Company, Limited, will apply for authority to define and regulate their existing capital, apply it for the purposes of the intended Order, and raise more money for carrying on their undertaking. The Order is to confer further powers in regard to the price, pressure, quality, and testing of gas, the rate of dividend to be paid, the supply of fittings and apparatus, and the sale of gas in bulk.

Cranleigh Gas.—Application will be made by the Cranleigh Gas Company, Limited, for authority to construct and maintain additional works on certain lands described, and to raise more capital. Further powers are required in regard to the supply and consumption of gas, including, pressure, quality, and testing; and provision is made for the adoption of a sliding-scale of price and dividend.

East Kent District Water.—The East Kent District Water Company will apply for an extension of their limits so as to include Wootton, Swingfield, Acrise, Poulton, and Hougham Without, all in Kent, or some part or parts of them. Additional capital will be required.

Highbridge Gas.—The Highbridge Gas Company, Limited, will apply for power to maintain, continue, and construct gas-works, and supply gas in the parish of Highbridge and parts of the parishes of Burnham Without and Huntspill, in the county of Somerset. In the Order to be applied for, provisions will be inserted in regard to the price, quality, pressure, and testing of gas, its sale in bulk, the supply of fittings and apparatus, and the erection of dwelling-houses for the employees. Authority will be sought to capitalize money expended out of revenue on extension and improvement of the works, to raise more capital, and form reserve, renewal, and special purposes funds.

Llanidloes Gas.—The Llanidloes Gas Company, Limited, intend to apply for authority to maintain and continue their works and supply gas in the borough of Llanidloes and in the parish of Llanidloes Without, in the rural district of Newtown and Llanidloes. In the Order to be applied for, provisions will be included in regard to the capital and borrowing powers of the Company, the amount of dividend and interest, and the formation and application of reserve and renewal funds.

Ripley Gas.—The Ripley Water-Works, Gas, Light, and Coke Company, Limited, purpose applying for authority to maintain and continue their existing works, and supply gas in the portion of the parish or township of Ripley which is not included within the limits of the Riddings District Gas Company, and also in part of the parish or township of Pentrich, in the county of Derby. The usual powers granted to gas companies will be applied for.

Rowley Regis and Blackheath Gas.—Authority will be sought by the Rowley Regis and Blackheath Gas Company to extend their limits so as to include the township of Cakemore, in the rural district of Halesowen, and to exercise therein all their present powers with respect to the supply of gas. The Order will include further general provisions, and others to sanction raising additional capital.

Sheffield Gas.—The Sheffield Gas Company will apply for authority to make further provision in regard to the quality and testing of gas, reduce the illuminating power, and prescribe the burner for testing it. It is proposed to hold in future only one ordinary meeting in each year, to make provision as to the retirement of the Directors, the payment of interim dividends, the preparation and audit of the Company's accounts, and the issue of debenture stock.

South Kent Water.—Application will be made by the South Kent Water Company for power to raise additional capital, and to apply the auction clauses to it, as well as to any of the existing capital that has not been issued. Authority will be sought to supply fittings, &c., to exempt them from distress, and to make agreements for the sale of water in bulk.

Sudbury and District Gas.—The Sudbury Gas Company, Limited, will apply for authority to maintain and continue their works, and supply gas in the borough of Sudbury and in the parishes of Great Cornard and Chilton; also to make provisions with regard to their capital and borrowing powers, the amount of dividend and interest to be paid, and the formation and application of reserve, renewal, and special purposes funds.

Sutton District Water.—The Sutton District Water Company intend to apply for an extension of their limits of supply so as to include the parish of Kingswood, in the rural district of Reigate, in the county of Surrey; for the confirmation of their existing works; for authority to construct a line of pipes and a water-tower; and for permission to use for the purpose any of the capital they may have already been authorized to raise.

Swansea Gas.—The Swansea Gas Company will apply for an extension of their limits of supply so as to include so much of the parish of Llansamlet as is not within the authorized limits of any statutory gas company, and certain portions of the parishes of Claise Rural, Penderry, and Cockett, in the county of Glamorgan. They will also seek permission to sell gas in bulk.

Local Government Board, under the Public Health Act, 1875, and the Gas and Water Works Facilities Act, 1870.

Oxford Water.—The Corporation of Oxford intend to apply for the confirmation of the acquisition by them of a piece of land at Shotover Hill, and for authority to hold and use it for the purposes of their water undertaking; also for sanction and confirmation of the construction of a service reservoir and other works, and the expenditure incurred in connection with it. Additional borrowing powers are required.

Warsop Gas.—Authority will be sought by the Warsop Urban District Council to supply gas within part of their district, and to erect, on a piece of land described, the necessary works and plant. Confirmation is required for any agreement made with the Mansfield Corporation relative to the transfer to the Council of the rights, powers, and privileges of the Corporation in respect of the supply of gas within the district, and for the repeal of so much of the Mansfield Commissioners' Gas Act, 1878, and the Mansfield Corporation Act, 1901, as relates to the area comprised within the limits of the intended Order. The Corporation wish for authority to purchase gas in bulk, and supply it beyond the district. The other provisions of the Order will relate to the purchase, sale, and hire of stoves, fittings, &c., the recovery of rents, rates, and charges, exemption from penalties, &c. Borrowing powers will be required.

Secretary for Scotland, under the Private Legislation Procedure (Scotland) Act, 1899.

Aberdeen Corporation Water.—The Corporation of Aberdeen will apply for authority to construct a reservoir on the River Avon, and various aqueducts and other works. Where lands are obtained by compulsory purchase, the amount of compensation is to be determined by a single arbitrator. Existing funds are to be applied to the purposes of the Order; and sanction to the borrowing of more money will be asked for.

Clydebank and District Water.—The Clydebank and District Water Trustees wish to be empowered to construct additional works, comprising an enlargement of the Burn Crooks reservoir and the making of a catchwater conduit, a pipe-line, an access road, and a road diversion, and to abandon two reservoirs, a catchwater conduit, a pipe-line, and an access road authorized by an Order granted in 1906. The existing borrowing powers are to be applied in carrying out the proposed works.

Dunblane Gas.—The Dunblane Gas Company, Limited, seek authority to maintain and continue their existing works, construct others, and manufacture and supply gas in the parish of Dunblane, in Perthshire, and also to sell it in bulk. The present capital is to be regulated, and it is proposed to increase it.

Falkirk Corporation Gas.—Application will be made by the Corporation of Falkirk for authority to borrow money for the purposes of their gas undertaking, reduce the illuminating power of the gas, prescribe and regulate its testing, charge differential rates, and allow discounts. The Corporation seek to be relieved from penalties for insufficient pressure or illuminating power of gas, for excess of impurity in certain circumstances, and for unavoidable interruptions in the supply.

Fraserburgh Water.—The Fraserburgh Corporation will apply for authority to construct additional works, consisting of an embankment or dam on the Water of Fedderate, a service reservoir in the parish of Strichen, filters in the parish of Fraserburgh, three conduits, and a road diversion. Permission will be sought to prescribe and regulate fittings and supply them, to make agreements with regard to the sale of water in bulk, to apply existing funds to the purposes of the Act, and to borrow more money.

Glasgow Gas Consolidation.—The Corporation of Glasgow will apply for the consolidation, repeal, and amendment of their Gas Acts, and for the maintenance, improvement, enlargement, or discontinuance, of the gas-works, and the continuance of the supply in the city, suburbs, and adjoining places. Power will be sought to divide the limits of supply into two districts, to be called respectively the "City" district and the "Supplementary" district; to fix the maximum price to be charged for gas; to provide gas-pipes and other apparatus, and repair them; to manufacture and supply gas for non-illuminating purposes; to make provisions in regard to the pressure, illuminating power, and testing of gas, &c. The Corporation wish to be authorized to apply for the benefit of the gas undertaking any surplus revenues arising therefrom, or to place them to the Common Good fund of the city; also to pay superannuation allowances to employees in connection with the gas undertaking, and to acquire gas-works in the area of supply or in adjoining districts. The Bill will contain provisions in regard to the borrowing of money temporarily for the purposes of the undertaking, the creation of sinking, reserve, and depreciation funds, and other financial matters.

Kirkcaldy Corporation.—The Corporation of Kirkcaldy will apply for an extension of the burgh, and consequently of their compulsory limits of water supply. They will also seek to amend or repeal the existing provisions of the Acts relating to the Kirkcaldy Gas Company (whose undertaking it is intended to acquire) with respect to the illuminating power and testing of gas, and make others in lieu thereof. The Corporation wish to be authorized, should any surplus remain on the revenues of the gas undertaking, to carry it, or such part of it as they think fit, to the general assessment of the burgh.

Montrose Water.—Application will be made by the Montrose Corporation for authority to consolidate their powers with reference to their water-works, to provide an additional supply to the borough and districts and the adjacent places, and to construct further works, consisting of a storage and a service reservoir in the parish of Montrose, and various aqueducts, &c. Confirmation will be sought for existing works. The limits of supply will be defined in the Order, in which sanction will be asked to the borrowing of more money.

Wishaw Burgh Extension.—The Corporation of Wishaw notify their intention of applying for an extension of the burgh so as to include the area within the parishes of Dalziel and Cambusnethan; and they wish to have the annexed districts included within their limits of compulsory water supply.

Double Fatality at Southampton.—Two working men, named Peter Reid and Charles Beer, who lodged at Southampton, were poisoned by gas in their bedroom under circumstances which the Coroner's Jury found to be purely accidental. The gas-fittings were in good order; but from the evidence of one witness it appeared that she found the tap of the bracket turned on. In the case of one of the men artificial respiration was tried for some time, and the Gas Company sent along a cylinder of oxygen; but though he was breathing when removed from the room, all the efforts made were without avail.

Mr. J. G. Newbigging's Address.—The current number of the "Municipal Journal" contains the major portion of Mr. J. G. Newbigging's recent address to the Manchester Association of Students of the Institution of Civil Engineers, which was given in the "JOURNAL" for the 16th inst. (p. 466). Our contemporary says the address "contains one of the strongest protests and best-reasoned arguments against the policy of relieving the rates out of municipal trading concerns that have yet been offered." The writer points out that the policy of rate relief from gas profits is to Mr. Newbigging no mere matter of opinion. It is "one of the greatest evils of municipalization," and "a pernicious system of indirect taxation which has been allowed to eat itself like a canker into this branch of the public service in such a manner as to be well-nigh incurable in these days of advancing rates."

LEGAL INTELLIGENCE.

INTERCHANGE OF THAMES WATER BETWEEN DISTRICTS

HIGH COURT OF JUSTICE—KING'S BENCH DIVISION.

Thursday, Nov. 25.

(*Before Mr. Justice* PHILLIMORE.)

Conservators of the River Thames v. Metropolitan Water Board.

This was an action to obtain a declaration of the rights of the parties as to the amount of water taken by defendants through the intakes of the old Southwark and Vauxhall Water Company.

Mr. ELDON BANKES, K.C., and Mr. C. B. MARRIOTT appeared for the plaintiffs; Mr. DANCKWERTS, K.C., and Mr. A. B. SHAW represented the defendants.

Mr. BANKES said the question, broadly put, was whether or not the defendants had a right to "interchange" water between districts; the actual question being whether they were authorized to pass water which was drawn through the intakes of the old Southwark and Vauxhall Water Company into the district of either the Lambeth or New River Companies. The Water Companies were constituted under Acts of Parliament; and the Lambeth and Southwark and Vauxhall Companies drew their water from the Thames. The Conservancy gave their consent to the water being taken subject to a certain payment from time to time by agreement; and by Acts of Parliament the quantities of water which might be abstracted from the river had been defined, as well as the amounts to be paid. Each Company was allowed to take a certain quantity. In the case of the Lambeth and Southwark and Vauxhall Companies, it was 24½ million gallons per day for a specific payment. Then came a period when the Companies were allowed to take excess quantities. Certain rights were given to some of the Companies to interchange water; and the question for the Court was whether or not the defendants, as successors of the Southwark and Vauxhall Company, had a right to pass any of this water, or alternatively any quantity of the excess water, from their old district into the Lambeth and New River Companies' districts.

The learned Counsel having called attention to the provisions of the various Acts of Parliament and the agreements under which the Water Companies drew water from the Thames, considerable discussion ensued as to whether, upon the pleadings as they stood, the question was as to all water taken, or merely excess water; Mr. Danckwerts strongly maintaining that it was merely the latter, and that he had never objected to a declaration that the Board could not send excess water from one district to another. His Lordship thought the section bearing upon this question related to all water; but Mr. Bankes said he was quite willing the decision should be confined to excess water, and that another action should be brought as to the other water.

Mr. BANKES then proceeded to argue that, under the agreement of 1852, the Southwark and Vauxhall Company could only supply their own customers; section 15 of the Act of 1878 gave them no right to supply any portion of their water to any other Company, though the agreement of December, 1886, conferred the right to supply any of the other five Companies. But, on the true construction of the Act of 1894, they had no right to supply such water. The Act of 1898 drew a clear distinction between the parliamentary limits and their actual district. Even if section 19 applied to excess water, defendants could not supply water to Lambeth; and it was useless to say that part of Lambeth was within the statutory limits of the old Southwark and Vauxhall Company.

Mr. *R. A. Swarbrick* produced a record, made from the returns furnished to the Conservancy by the defendants, of the quantity of excess water taken by them. He said these returns did not afford any information to the Conservators as to what happened to the water after it was taken. Beginning with May, 1905, it appeared that during every month to the end of the year water in excess of 24½ million gallons per day was taken. The records showed substantially the same result during each subsequent year. It was not till the Conservators received the third annual report of the Board that they became aware of water being supplied from the Southwark and Vauxhall district to the Lambeth and New River districts. A plan produced showed the connections between the districts.

Cross-examined: He assumed that the "total gallons per day" in the returns referred to the number of gallons drawn at the intake, and not the quantity pumped out of the reservoir into the district. He was not aware that in the returns made to the Local Government Board the word "Thames" included other water than that drawn from the river. If this were so, his figures would require amending.

Mr. *H. J. Froome* said it had been the practice of the Conservancy Board to render accounts half yearly for excess water. These accounts were paid up to 1906, after which the Metropolitan Water Board commenced to make payments on account.

Friday, Nov. 26.

Mr. DANCKWERTS, in opening the case for the defendants, said the action was a most important one; for if the plaintiffs succeeded, it meant an additional expenditure by the Water Board of more than £18,000 a year. He explained that the water supplied by the Board was taken from three intakes on the Thames, pumped into reservoirs and thence into filter-beds, from which it was distributed partly by gravitation. But some was pumped to Nunhead, from which reservoir it could be sent into the Southwark and Vauxhall district and part of the Lambeth district. The Lambeth Company also had service reservoirs which were capable of supplying both of these districts. In addition, there were gravel beds on the north side of the river from which water was intercepted; and this was not included in the return of water taken from the Thames. It made practically little difference whether a certain quantity of water was drawn out of the Thames at the Lambeth or the Vauxhall intake, though the advantage to the Conservancy was that it should be drawn at the latter. Similar remarks might be made about

the Chelsea intake—in fact, it was true as to all the other intakes. The Vauxhall scale for excess water was higher than the Lambeth; so that it was clearly to the advantage of the plaintiffs that the water should be taken at Vauxhall.

Justice PHILLIMORE: Then why not accept the view they set up?

Mr. DANCKWERTS: Because of physical necessities. If the Court accepted the view put forward by the plaintiffs, the defendants would have to send the water a distance of 22 miles instead of only 2, which would involve a cost of £18,000 a year for pumping. Counsel went on to say that under sundry Acts of Parliament the Water Companies were authorized to supply each other; but this power *ex necessitate* disappeared under the Act of 1902. As illustrating what he meant, he would suppose that there was an area which belonged to Lambeth and also to Vauxhall; as they both now belonged to the Water Board, why should that area not be supplied from either intake?

Justice PHILLIMORE: No doubt if you were laying down pipes in a new district you might take the water from the nearest point.

Mr. DANCKWERTS thought this might be done. The Vauxhall Company, besides the intake from the Thames and gathering water from gravel beds, had wells which were so situated that water from them could not be delivered into the New River district. The water from the wells was sent from the Hampton filter-beds to Nunhead, and a good deal of it was distributed while on its way. There was no fetter on gravel water; the only fetter was on water drawn at the intakes. He had had a table prepared showing the average quantity of water obtained daily from the gravel, and the average daily supply to the Southwark and Vauxhall district from the gravel, and it appeared from it that there was a margin of more than a million gallons; and the contention of the defendants was that, in any view of the case, they were entitled to use this water anywhere they pleased.

Justice PHILLIMORE pointed out that he was not asked to decide whether gravel water was Thames water.

Mr. DANCKWERTS said the defendants had never sent into the New River district any water drawn at the Thames intake.

Mr. MARRIOTT observed that this statement was inconsistent with the pleadings, as it was stated that the defendants had not done so since 1907; and they now made no claim to do so. No point was raised about gravel water.

Justice PHILLIMORE said he was willing to decide anything the parties wished him to decide; but it might end in his giving a decision as to gravel water which neither party might like.

Mr. DANCKWERTS did not agree that the point was not raised on the pleadings. The defendants said no excess water had been sent to the New River district, and that they had never supplied to it any representative of water drawn from the intakes. He would suggest that the case should be adjourned and the pleadings amended, so that the exact point to be determined might be raised.

Justice PHILLIMORE: Do the Water Board mean to say that they did not send some Southwark and Vauxhall water, not being gravel or well water, into the New River district before 1907?

Mr. DANCKWERTS: No human being, however able, can say whether or not drops of water coming from the intake of the Thames go outside the Southwark area. Under the Acts of Parliament, the water from all sources is commingled in the reservoir.

Mr. BANKES said if the defendants had pleaded that they did not claim, and never had claimed, to send any water out of the Southwark supply district, and that all they had done was to use gravel water, the case would have been different.

After some further argument,

Justice PHILLIMORE said perhaps Mr. Danckwerts would say what it was he wished to raise.

Mr. DANCKWERTS: We take up this position—that all the waters are commingled. We admit that, so far as the water distributed is representative of water other than the 24½ million gallons and other than gravel and well water, it cannot be used except in the old Southwark and Vauxhall district; and, apart from that, we say we can use all the water where we like.

Mr. BANKES: The question my friend wishes to raise is whether he is entitled to exclude gravel water from Thames water. I think it better to amend the declaration, and allow the case to proceed.

Mr. DANCKWERTS asked for leave to amend his defence, so that the real issue might be raised.

Mr. BANKES said he had reconsidered the matter, and, seeing that two public bodies were concerned, it would be better to have the real question determined. He understood the defendants wished to raise the following points: (1) Whether they were entitled to interchange the 24½ million gallons; and (2) whether they were entitled to treat the gravel water as being water other than Thames water.

Mr. DANCKWERTS: Other than water drawn from the intake of the Thames.

Justice PHILLIMORE: Other than water under the section.

Mr. DANCKWERTS: Does my friend contend that gravel water comes within the limits prescribed by the Act of 1898?

Mr. BANKES: I do.

Mr. DANCKWERTS: Then I will contest that.

His LORDSHIP ordered the case to stand over generally, so that the pleadings might be amended.

ALLEGED WRONGFUL APPROPRIATION OF WATER.

HIGH COURT OF JUSTICE—CHANCERY DIVISION.

Wednesday, Nov. 17.

(*Before Mr. Justice* PARKER.)

Borough of Portsmouth Water-Works Company v. London, Brighton and South Coast Railway Company.

This was an action brought by the plaintiffs to prevent defendants from taking water from a spring, termed the "Railway" spring, yielding 600,000 gallons a day, on their land at Bedhampton, near Portsmouth.

Mr. BUCKMASTER, K.C., and Mr. TOMLIN (instructed by Messrs. Bramsdon and Childs, of Portsmouth) appeared for the plaintiffs; and Sir ALFRED CRIPPS, K.C., Mr. YOUNGER, K.C., and Mr. PRIOR (instructed by Mr. P. V. Rose) represented the defendants.

Mr. BUCKMASTER, in opening the case, gave a history of the circumstances which led to the present dispute. In 1845, the defendants' predecessors obtained an Act for making a railway from Chichester to Portsmouth, and for this purpose acquired, in the parish of Bedhampton, a piece of land 18 perches in extent, which was entirely covered with water. The conveyance, which was dated in 1848, contained a reservation to the vendors of all water rights. The vendors were owners of two estates known as the Upper and Lower Bedhampton Mill Estates, which, by deeds in 1855 and 1877, were conveyed to the plaintiffs. [Maps were put in showing a very considerable expanse of water, from which the two mills were operated; and it was fed by various springs, rising under the surface—two on the north of the railway line, known as the Bidbury springs, Wyatts' spring, and, as, the plaintiffs alleged, by the Railway spring. There was also a stream coming from St. Chad's well, and two springs known as the Blue Hole, which latter were, in fact, the main sources of supply. By the head of water, or millpond, thus formed the two mills had been worked from time immemorial down to and after the date when they were acquired by the present plaintiffs.] Having purchased the land on each side of the pond right down, the plaintiffs had full power to deal with the water as they thought fit; and they set about using it for the purpose of their undertaking. The first thing they did was to enclose in a brick cylinder Wyatt's spring, so as to preserve the water from pollution by surface drainage, and lay pipes from it to their pumping-station. This was done in 1889. In 1898, they enclosed the two Bidbury springs in a similar way; connecting them with the pumping-main from Wyatts' spring, and there being also an overflow-pipe to carry any surplus water into the pond—these pipes running underneath the railway. In 1900, the defendants wanted to extend the sidings on which their coal-trucks ran; and for this purpose they made an embankment across the head of the pond, but south of the Railway spring. Through this embankment a 42-inch pipe was laid to carry the water rising to the north of it, which would have been entirely unnecessary but for the existence of the spring. While this embankment was being constructed, the plaintiffs, by agreement with the defendants, laid a 32-inch main from their pumping-station to the reservoir at Havant. Correspondence took place between the two Companies as to what should be done with the portion of the millpond above the embankment; and an agreement was at first come to under which a retaining-wall was to be built round the Railway spring. This, however, was not carried out; but early in 1903 it was suggested that a cylinder should be sunk where the spring rose, and that the water should be taken away from it to the works. Ultimately this was agreed to, and the work was done; the cylinder being sunk about 15 feet—a wall being built round it for protection, and the water being carried away into the 42-inch main by a 20-inch pipe. The rest of the area north of the embankment was thus left dry, and the Railway Company's land was dry, instead of being covered with water. The rights under the agreement continued until September, 1907, when they determined in consequence of a notice served by the defendants, in March. After this, the defendants proceeded to put a pipe into the cylinder, and by means of a small windmill pumped the water out, and carried it away for their own use; and this led to the present action. The defendants now said there never was a spring there from which water flowed into the millpond; and, being on their own land, they had a right to the water. They also said the plaintiffs had no right to the water, either *jure naturæ* as flowing water, or by virtue of the reservation of all water rights in the conveyance of 1848.

Sir ALFRED CRIPPS said one point in dispute was whether this was really a spring; and, secondly, if one did originally exist, whether it had not been destroyed by what the plaintiffs had done elsewhere.

Mr. BUCKMASTER said he thought the contention was that the plaintiffs created the spring rather than destroyed it. He then proceeded to put in the various conveyances and agreements bearing on the question. In the conveyance of 1848, the defendants agreed in no wise to obstruct the full flow of water "in the said stream to the said millpond." But this was the first time the word "stream" occurred in the deed; and he submitted that it could only mean the stream in the pond itself, which was kept flowing by the various springs he had mentioned, including the Railway spring. The law with regard to flowing water was well known, apart from any special reservation in the deed. No man had a right to underground water, unless it flowed in a channel, both defined and known. If a man had a well or a pond fed by an underground stream, if a right to the underground water could not be claimed, the water while underground could be intercepted. It was equally plain that when once the water emerged and flowed in a defined stream, the right to it arose; and if a man had a pond fed by such a stream, no one above him had a right to intercept it.

Sir ALFRED CRIPPS said he should not dispute either of these propositions.

Mr. BUCKMASTER said he should also contend that if a man had a pond fed by springs beneath the surface, another man owning the upper part of the pond where the spring rose was not at liberty to drain the pond and stop the springs. There was not much authority on this; but there was one case—*Ennor v. Barnwell*, which came before Vice-Chancellor Stuart in 1860—which would support the conclusion.

Evidence was then given on behalf of the plaintiffs.

Mr. *William Whitaker*, F.R.S., said he knew the district in question well, having been over it for the Geological Survey. He handed in a geological map and explained the nature of the strata. He said the water in the springs alluded to was forced up to the surface by the pressure of the water impounded in the chalk deposits to the north. It flowed out first at the lowest weak place, which happened to be at Bedhampton and the neighbourhood. The ground around the Railway spring was fairly firm, not marshy. The water came up with pressure enough to overflow.

Cross-examined: He knew the Bidbury springs before they were enclosed by the Water Company. He could not say, without testing, whether these springs affected the Railway spring. He did not remember ever seeing the millpond dry; but he had heard of it. He knew the 36-inch main which passed near the Railway spring. He knew there was an overflow at times from the Bidbury springs; but he could not say to what extent. He inspected the whole of the plaintiff

Company's works with reference to the Bill of 1896; and he was there for nearly a day about a fortnight ago. He had also seen them at various other times going back before 1896, before the upper part of the millhead was filled up. The cylinder at the Railway spring was put down 15 feet below the level of the water in the pond. He did not know the exact depth of the 36-inch pumping-main. Such a main might have the effect of forming a channel for the water from the chalk. The Bidbury east spring was at a higher level than the pond. Before they were enclosed, the water flowed under the railway into the pond. If they were pumped, it would affect other springs in the vicinity. The natural exit of the Railway spring was into the pond. The cylinder was an artificial work; and he did not see how it could affect the quantity of flow. He was not aware that the quantity of water drawn from the cylinder had increased. A few weeks' or months' experience would be of no value, as so much depended on the rainfall. Perfectly dry chalk would hold about 25 per cent. of water; but one could not get it out except by heat or the pressure of other water upon it.

Re-examined: The Railway spring had no relation to an artesian well. There were no mechanical means used at the spot to take the water away; it flowed away naturally. The presence of the cylinder would not increase the flow to any appreciable extent. He did not think the existence of the rising main near the Railway spring could affect it. The millpond could be emptied at any time by opening the weir at the bottom. When he first knew the Bidbury springs, the Company were not taking water from them. Pumping at the springs would decrease or entirely stop the flow at the Railway spring.

Mr. *E. M. Eaton* said he had visited the *locus in quo*, and had known it for many years. The key to the situation was the ridge known as Portsdown Hill. To the north of this was a large area of exposed chalk, which received the rainfall that flowed to the south after being absorbed. But for this hill, the outflow from the chalk would pass into the sea through a multitude of little channels and streams, as it did all along the Sussex coast; but the existence of Portsdown Hill constituted a barrier, and prevented the water passing direct into the sea, and deflected it until it reached the weak spot through which it could pass, as it did at Bedhampton and Havant, and poured out in copious streams. He could not conceive it possible that the Railway spring had been sealed up, as it were, for a long time, and then had suddenly developed. There was nothing to suggest that it ever existed in any other position. In his opinion, it broke out originally in the bed of the pond; now it came out on the siding, about 6 feet higher, so that there was sufficient head to force it up through that depth of gravel.

Cross-examined: The water must come up from the chalk, which was about 32 feet below the surface. It must come through a fissure in the more or less impervious stratum above the chalk. He examined the spot critically in connection with the Bill of 1906; and it was then in substantially the same condition as now. Probably the water would rise in a cylinder placed anywhere in the immediate vicinity.

Mr. *Joseph Hawksley*, Manager of the Great Yarmouth Water-Works, said he was from 1895 to 1899 Assistant-Manager to plaintiff Company. He was familiar with the position of the various springs at Bedhampton, including the one now in question. In 1898, the water was run off from the millpond for the purpose of laying the pipes from the Bidbury springs, and he remembered perfectly seeing the water bubbling up from the Railway spring over an area of about 3 feet in diameter—a small group of springs. It rose continuously the whole time; but he made no estimate of the quantity of water. His only object then was to get rid of it. The ground all round it was hard and firm. He saw no sign of boggy or marshy land there; but the ground was rather loose just where the spring rose.

Cross-examined: The water was run off from the pond for about four or five weeks. He did not remember the water being drawn off entirely after that, so as to expose the spring; but when the pond was low, he had seen the water bubbling up from the bottom.

Thursday, Nov. 18.

Mr. *Hawksley*, in further cross-examination, gave a detailed account of what was done in the summer of 1898, when the millpond was run off, and pipes were laid from the Bidbury springs. He said there was a considerable flow of water from the Railway spring; but he did not make any gaugings, and would not attempt to estimate the quantity. He put a mark on one of the plans to indicate the site of the spring in question. The level of the water in the pond might have varied from time to time; but he could not say to what extent.

Re-examined: The 24-inch pipe was just buried beneath the surface of the bed of the pond. When the water was drained off, there were streams running through the pond from the Bidbury springs and the Railway spring. The summer of 1898 was very dry, and this led to the need for enclosing the Bidbury springs and utilizing the water from them. The surface of the pond was varied by the use of the hatches for the purposes of the mill.

A number of local witnesses were then called. Later,

Mr. *Charles Pettit* said he was Resident Engineer under Sir John Aird and Sons when they were laying the 36-inch main. He was on the works almost daily from May to December, 1901. When he first went, the pond had been drawn off. He examined the bottom as far as he could, and found the Railway spring in the spot where it now was. There was a considerable flow of water from it, but he could not state the quantity. The main was laid on piers, just above the bottom of the pond. There was no sign of boggy land. No other spring was found; and he did not think any pumping was required. If he had had to carry away the water from the Railway spring, he should have put in a 9-inch—possibly a 12-inch—pipe. Nothing they did affected the spring in any way.

Cross-examined: In making the subway under the railway to carry the main, they did not find any spring; nothing beyond surface water which could be baled out with shovels. He did not remember telling Mr. Morris, of the defendant Company, in September, 1901, that he had discovered a valuable spring of water—enough to fill a 2-feet pipe—and asking him to come and see it. He had no recollection of anything of the sort. He first saw the spring on May 16 as shown by his diary, before any work was done. The 42-inch pipe was put in before he had anything to do with the work.

Re-examined: If he had any conversation with Mr. Morris about a spring, it must have referred to the Railway spring, as they came across no other.

Mr. *H. R. Smith* said he entered the plaintiffs' service in 1867, in 1872 became Resident Engineer, and continued to hold this office until 1902, when he retired. He knew the spring in question as far back as 1867, and he had known it officially since 1878. In 1867, the millpond did not belong to the Company, but when they acquired it he made an official examination of all the springs. He could see the water rising, even when the pond was full; but when the water was down it was more prominent. There was a considerable volume of water; but he could not give the quantity. There were many occasions when the hatches were raised and the water was run off from the pond. During the whole of his time nothing was done to this spring. Wyatts' spring was enclosed in the summer of 1889. His opinion was that the spring had existed from time immemorial.

Cross-examined: The Railway spring was 20 feet or more from the stream running down the bottom of the pond from the Bidbury springs. It was a large spring, yielding, he should think, not less than half-a-million gallons a day. The 1896 Act authorized the enclosure of the Bidbury springs. He had no records of the quantity they yielded; but they were each more powerful than the Railway spring.

Re-examined: The spring was very near the camp sheeting, and practically abutted upon it. The main spring was 3 or 4 feet from it; but a little water dribbled through.

Mr. *Joseph Quick* said he and his father had been Consulting Engineers to the plaintiff Company since its formation; and he was thoroughly acquainted with their various sources of water. In the millpond there were Wyatts' spring and the Railway spring. He knew the latter 25 years ago. He had seen the pond emptied on various occasions, and particularly when the 36-inch main was being laid. [Mr. Quick described the appearance of the spring in much the same way as previous witnesses had done.] He prepared the plans for the 36-inch main, which was laid on 4 ft. by 3 ft. piers 2 feet above the bottom of the pond. The foundations went down about 3 ft. 9 in. The main passed under the railway in a subway, in constructing which no springs were found, and nothing was charged by the Contractors for pumping or the hire of pumps. The work on the main was finished before the embankment was completed.

Cross-examined: He could only make a guess at the quantity of water yielded by the spring; but he should not differ from Mr. Smith. Witness was examined in some detail on his plans for carrying the main under the railway. He said that he superintended the work, and visited it from time to time.

Mr. *A. E. Stallard*, Surveyor to the Havant District Council, said the Hermitage stream came under his attention. It rose about 2 miles above the *locus in quo*, and consisted chiefly of surface and soakage water. Sometimes it was nearly dry; and not much reliance could be placed upon it for mill purposes.

Justice PARKER suggested that this evidence was not material.

Sir ALFRED CRIPPS assented, and the witness withdrew.

The further hearing of the case was adjourned.

Tuesday, Nov. 23.

When the case was resumed this morning,

Mr. *Herbert Ashley*, M.Inst.C.E., the Chief Resident Engineer of the plaintiff Company, was the first witness. He said he did not know the *locus in quo* before his appointment in 1902. The condition of things was shown in a plan which he prepared at the time. There was water then running under the embankment through the 42-inch pipe; it came from the Railway spring, and a little through the camp-sheeting. There was no other source for it; and the quantity was considerable. The overflow from the Bidbury springs entered the millpond below the embankment; and the hatches were raised so that the bed of the pond was exposed. In the early part of 1903, he proceeded to put down the cylinder round the Railway spring. It was put down in January, 1903; and its total length was about 16 ft. 6 in.—some 18 inches being above the bottom. The cylinder was in four sections—first a cutting edge, and then a length of 6 feet bolted on to it. The soil within was removed, and the cylinder then sank by its own weight. Its internal diameter was about 4 feet; and the lower portion (about 7 ft. 6 in.) was perforated. The result was that the supply of water was concentrated, and it drew in the water which formerly came through the camp-sheeting; but the total quantity was not affected, so far as could be judged without accurate measurement. A brick wall was built round the cylinder, and from the enclosure thus made a pipe was taken to the 42-inch pipe under the embankment. The soil removed from inside the cylinder was loose gravel.

Cross-examined: He agreed with the evidence of Mr. Eaton as to the character of the springs. Assuming the enclosure of the Bidbury springs increased the flow, he did not see that it would affect the Railway spring. In September, 1902, the upper part of the pond, above the embankment, was dry, except for the water coming from the Railway spring. Water for drinking purposes was taken from the place shown on the plan as "part of the old mill-head." It was not contaminated with surface drainage, which was carried off by pipes. Before Wyatts spring was enclosed, the water from the Hermitage stream mixed with the body of water in the pond; and he gathered that this was the reason for enclosing the spring, which was before his time. The line of camp-sheeting ran from the boundary of the Railway Company's property up to the bridge. His recollection was that the volume of water from the spring in 1902 was the same as at present. In his opinion, the sinking of the cylinder had not affected it. The spring was 70 feet from the level crossing. A photograph showed the Bidbury west spring. The outside wall was merely a boundary; inside this was another wall, the depth of which he did not know. There was no cylinder. The water was taken direct to the pumping-station from the level of the bottom of the pond, about 2 feet below the top of the spring. In 1902, negotiations were proceeding between the two Companies as to how the water from the Railway spring should be dealt with. Some of the correspondence was read, and witness explained what he meant by the expression "if I am successful in tapping the main spring." He said he did not mean that

he expected to find a new spring; but to concentrate various runnels within the cylinder. Another expression, "It is, of course, problematical if we can tap the spring in this manner or not," had the same meaning. He understood the Railway Company intended filling in the part of the site of the old pond which belonged to them. A letter was sent from the Secretary of plaintiff Company to the defendants in September, 1905, suggesting that the former should purchase any rights the latter had in the spring; and in the Bill of 1909 a provision was inserted for purchasing the land on which the spring rose, and also the water rights. This was opposed by the Railway Company, and was rejected, with many other portions of the Bill. The witness's evidence before the House of Lords Committee was referred to, in which he mentioned a boring at the Bidbury spring, 118 feet deep, and said it affected the flow of water from the adjoining springs. The subway in which the 36-inch main was carried under the railway was nearly constructed before he took office; it was done entirely under the supervision of Mr. Quick.

Re-examined: He attached great importance to the Railway spring as a source of supply. He had experimented with the boring at the Bidbury spring, by cutting it off; and in this way he ascertained that it affected the other springs in the vicinity.

Mr. *W. O. Bailey*, Works Superintendent to plaintiff Company since 1891, said on entering the Company's service he made himself acquainted with the whole of the sources of supply, as well as the works. The Railway spring was then as shown in the photograph and as described by the previous witnesses. He described the laying of the 36-inch main and the 42-inch pipe over which the embankment was afterwards put. With regard to the puddle being less in quantity on one side of the main than the other in the subway, this was very simply explained. There was a leak in the main, to repair which some of the puddle had to be removed; and it had not been replaced. The only trace of water in the subway was close to the camp-sheeting, and came from small feeders of the spring.

Cross-examined: There was no change in the Railway spring after the Bidbury spring was enclosed. The clay was put in 18 months after the subway was constructed, partly at his suggestion, in order to preserve the main. At that portion it was a steel tube; and it was deteriorating from the damp atmosphere.

This concluded the evidence for the plaintiffs.

THE WELSBACH COMPANY'S TRADE MARK.

Clerkenwell Police Court.—Saturday, Nov. 20.

(*Before Mr.* BROS.)

As briefly recorded in the "JOURNAL" last week, the hearing of this case was continued on the above-named day. It will doubtless be remembered that it was a summons taken out by the Wolfram (Tungsten) Metal Filament Lamps, Limited, against the Welsbach Incandescent Gaslight Company, Limited, for selling and exposing for sale goods to which, as was alleged, a false trade description had been applied. [See *ante*, pp. 265, 332, 413.]

Mr. RUFUS ISAACS, K.C., M.P., Mr. H. A. COLEFAX, and Mr. ERNEST LUNGE appeared in support of the summons; Mr. A. J. WALTER, K.C., and Mr. BODKIN represented the defendants.

Dr. *Otto Oberlander*, a consulting chemist and engineer, examined by Mr. RUFUS ISAACS, stated that for a number of years he had followed the development of electric lighting and was familiar with the manufacture of metal filament lamps. He had previously seen the two lamps produced, each of which was marked "Welsbach Auer." His examination of another lamp produced enabled him to say it was made of tungsten or wolfram. The osmium electric lamp was invented by Dr. Welsbach, and patented in 1898. These lamps were introduced into England on a commercial scale about 1903 or 1904. They were put on the market by the German Company, which he had seen called by several names in English publications—the "Auer Gesellschaft," the "Auer Company," and the "Auer Society;" and it was so known in this country. In 1904, a filament of wolfram or tungsten was proposed. The German Auer Company made lamps in accordance with this invention; and they were introduced into England by the General Electric Company. It would be right to describe a lamp of which the filament was made of osmium as the invention of Baron von Welsbach, but not one with a filament of tungsten; the two metals being totally different. He had never heard of the defendants making metal filament lamps.

In cross-examination by Mr. WALTER, witness said he knew that tungsten or wolfram was patented in 1889 for metallic filament lamps; but this did not lead to the tungsten lamp. Asked if he was aware that the name "Auer Gesellschaft" was dropped because of the complaint of the defendant Company, witness replied that it was dropped at the request of the General Electric Company, and the letters "G.E.C." were substituted. He did not know of any lamp, prior to the one now complained of, that had ever been put upon the market with the word "Welsbach" or with the letters "A U R" on it. The word "Welsbach" on merchandize in this country commonly meant goods of the Company, but it did not include electrical goods.

Mr. WALTER: Are you prepared to deny that the letters "A U R" upon merchandize commonly mean merchandize of the Welsbach Company?

Witness: I deny it in connection with electrical goods.

Do you suggest that Dr. Welsbach's inventions with regard to filament lamps were confined to osmium?—I do.

Have the defendants, to your knowledge, ever described the wolfram-tungsten lamp as the Welsbach lamp?—I have seen it so described in many publications; but it was wrongly described.

Mr. *Duncan Watson* said an advertisement he read conveyed to him the impression that the lamp referred to must be the osmium lamp under the Welsbach name. He formed this opinion because it had on it the words "Welsbach Aur."

In cross-examination by Mr. WALTER, witness said he had not known before he heard it in Court a fortnight ago that the trade mark of the Welsbach Company was "A U R." He had never seen a lamp labelled "Welsbach" except the one that was put on the market by the defendant Company.

The further hearing of the case was adjourned until next Saturday (Dec. 4).

Water-Works, Lighting, and Power Investment Corporation.

A case came before Mr. Justice Joyce last Tuesday as a "short cause," upon a motion for judgment in a debenture holder's action. Mr. Burgess stated that in September last a Receiver was appointed by way of equitable execution in the King's Bench Division, and on the 8th of October Mr. Justice Neville, sitting as the Vacation Judge, appointed a Receiver of the Company's assets. The plaintiff asked for the usual judgment in a debenture holder's action for accounts and inquiries. Counsel for the Company consenting, his Lordship made the usual order.

Convictions for Stealing from the Gaslight and Coke Company.

At the Old Street Police Court, last Tuesday, Henry Stephen Reynolds and Alfred Ward, both described as "fitters' labourers," employed by the Gaslight and Coke Company at their Haggerston station, were charged before Mr. Biron with being concerned together in stealing and receiving a gun-metal cock, value 15s., the property of the Company. Mr. Humphreys, who prosecuted, said Reynolds had previously been charged with the theft and been remanded. Ward, who had run away from the works as soon as he heard of Reynolds's arrest, had subsequently surrendered himself, and, after being formally charged, was also remanded, in order that the two men might be brought up together. Evidence having been given by employees of the Company, both prisoners now pleaded guilty, and elected to be dealt with. Mr. Humphreys said thefts of a similar description to the one before the Court had proved a source of annoyance and loss to the Company for some time, and an endeavour to find the perpetrators had resulted in the present charge. From inquiries it had been learned that the prisoner Ward had been suspected in a previous situation, and that things had ceased disappearing since he had been discharged. The Company, however, blamed the prisoner Reynolds in this case, as he was a stronger-minded man than Ward, and had, they thought, led him into committing the theft. Mr. Biron said it was deliberate; and he sentenced both prisoners to six weeks' hard labour.

The Barnet Appeal Case.—When referring to this case in the "JOURNAL" for the 16th inst., it was mentioned that it would, in all probability, be taken to the House of Lords. This has been done; and the appeal was presented and read last Tuesday, and the respondents were ordered to lodge a printed case in answer thereto on or before the 5th of January next.

Assessment of the Plymouth Gas Undertaking.—The Plymouth and Stonehouse Gas Company have decided not to proceed with their appeal against the new assessment of the gas undertaking. Referring to the matter at the meeting of the Company last June, Sir Joseph Bellamy stated that the rating authority had advanced the assessment of the undertaking from £5000 in 1901-2 to £10,000, though in the meantime there had been an increase of not more than 25 per cent. in the volume of their business. The Company gave notice of appeal, and the matter was mentioned at the Midsummer and again at the Michaelmas Quarter Sessions; but by consent the hearing was postponed until the January Sessions. At last Tuesday's meeting of the Plymouth Board of Guardians, the Clerk reported that he had received an intimation from the Gas Company that they did not intend to proceed further with the appeal. Mr. Lewis, the Chairman of the Assessment Committee, thought they were to be congratulated on the result of their action. The sum involved was one of £5500, and by dealing with such monopolies the Committee were doing something which should be commended. The income from the amount in question was equivalent to a rate of 1d. in the pound; and the increased assessment of other monopolies would probably yield another halfpenny.

Death from Gas Poisoning.—At Hornsey, a verdict of "Death by misadventure" was returned in the case of William Turner, aged 89 years, an iron puddler and an old-age pensioner. It was stated that it was deceased's custom to have a gas-jet lighted in his bedroom during the night. He was found in bed unconscious, suffering from coal gas poisoning; and he did not recover. The Coroner said that no doubt the man thought he had turned off the gas.

Improved Public Lighting in Southwark.—At the meeting of the Southwark Borough Council last Wednesday, the Works Committee reported that instructions were given in July last to the Borough Engineer to fix, by way of experiment, a number of new inverted gas burners (brought under their notice by the South Metropolitan Gas Company) on the lamps in Borough High Street. The experiment had proved satisfactory. With the exception of a very few cases, all the lamps of the Company in the Borough were fitted with No. 4 burners. The cost of these at present for light and maintenance was £3 2s. 10d. If the new inverted burner was fitted, the cost would in future be £2 19s. 6d., or a reduction of 3s. 4d. per lamp per annum. To obtain this result, however, it would be necessary to expend 3s. 1d. on each lamp for the purpose of conversion; so that, in the first year there would be a saving of only 3½d. per lamp. The present illuminating power of the lamps was 80 candles; but with the new burner it would be 120 candles. The Committee also proposed to do away with the compressed gas-lights at the London Bridge Approach, and substitute double inverted burners with an illuminating power equal to 240 candles. The cost of the compressed-gas system at the present time was £7 2s. 6d. per lamp per annum; whereas that of the double inverted burner lamp would be £5 5s. The Council resolved that all the lamps in the borough should be fitted with the new inverted burners, and that double inverted burners should be substituted for the present compressed-gas lights at the London Bridge Approach.

MISCELLANEOUS NEWS.

THE EXPLOSION AT THE GENEVA GAS-WORKS.

Restoration of the Works and Gas Supply—Cost of the Explosion.

Our readers may remember that towards the end of August last a serious explosion, unhappily attended by the loss of a number of lives, occurred at the Geneva Gas-Works. The extent of the damage done was partially shown in the reproduction of a photograph which accompanied the few particulars of the accident we were able to give at the time, and more fully in the "JOURNAL" for the 14th of September. Further light is thrown on the disastrous affair by the following extracts from a report which was recently submitted to the Municipal Council of Geneva, and which is contained in the current number of the "Journal de l'Eclairage au Gaz et à l'Electricité."

The work of clearing away the ruins of the demolished building [the purifier-house] was commenced on the very evening of the accident, and pushed on with the utmost activity. Great care had to be exercised, as the remains of the ferro-concrete ceiling of the house had to be taken down without damaging the purifiers and pipes beneath. As soon as this work was sufficiently advanced, attention was directed to the repair of the broken pipes; and these were joined up so that gas could be sent out without passing through a station meter or governor. The repair of the travelling crane for raising the purifier lids and the purifiers themselves was next undertaken; and then the roofing, doors, and windows were looked to. While this was going on, the retort furnaces were kept hot, though no gas was made; and the carburetted water-gas plant was examined and put into working order.

As soon as the repair of one of the purifiers had progressed sufficiently to allow of it being available in three or four days, gas making was resumed. On the 9th of September, the furnaces were heated up to their normal temperature, the water-gas plant was started, and the small holders (of 140,000 and 176,000 cubic feet capacity respectively) were filled. In the afternoon of that day, the governors for two of the districts were opened, and as soon as the pipes had been cleared of the air they contained, the supply of gas was restored, and the public lamps lighted. Next day gas was available for all the consumers in the city and suburbs; and the following morning (Sept. 11) it could be sent to the outlying communes. The stoppage of the works had lasted seventeen days. The work of setting the plant in order and conveying the gas to the consumers was difficult, and caused considerable anxiety to those who carried it out. Fortunately, thanks to the precautions taken, to the number of notices sent to the consumers, and to the prudence exercised by them in consequence, no accident, so far as is known, occurred in this connection.

Though the supply of gas has been restored, the situation is still critical. At the time the report was presented, great difficulty was experienced in carrying on the works, because from 1½ to 2½ million cubic feet of gas had to be supplied daily with the aid of the two small holders. This could only be done by carefully regulating the make of both coal and water gas as far as possible to the consumption. Since working has been resumed, a new governor has been fitted up and brought into use, and a new station meter installed. Things will not, however, have been restored to their normal condition until the large holder, of 530,000 cubic feet capacity, is in working order.

With regard to the cost of the accident, the damage done to the buildings and plant that were insured against fire and explosion, with the expense incurred in clearing the ruins, is estimated at 108,842 frs. (£4354). The city is its own insurer for half the damages, and the other half was in the hands of three Insurance Companies, who have paid 51,421 frs. (£2057) without raising the least difficulty. The remainder will be taken from the funds of the industrial fire insurance services of the Municipality. The cost of repairing the large holder, which was not insured, will also be paid out of these funds. The amount required will be about 70,000 frs. (£2800); and it will have to be gradually paid back into the fund. As to the other damages to the works and plant not covered by insurance, their repair will be charged to the maintenance account; and it is expected that the cost will be defrayed in one or two years.

Apart from the damage to the works, there was the regrettable loss of life. With respect to the families of the victims of the explosion, the law of employers' liability exacts payment of compensation to them. Claims were made in five cases, amounting to 6000 frs. (£240) per workman; but at the date of the report all had been, or were about to be, settled. In addition to the payment of the amounts legally due, and defraying the expenses of the funerals, attending the injured, and other incidental charges, everything necessary was done to assist the bereaved families. Thanks to the spontaneous outburst of public sympathy which followed the disaster, a sum of about 68,500 frs. (£2740) was placed at the disposal of a Committee specially appointed to deal with the requirements of the distressed families; and they are now engaged in administering these funds. There are five widows and eighteen children (twelve under eighteen years of age) to be assisted; and something will have to be done for the families of the men who were not actually connected with the gas-works. All these will receive their due share of the amount voluntarily subscribed.

The claims made in respect of damages to buildings outside the works, as well as for compensation for injuries sustained by persons more or less directly as the result of the explosion, were, at the date of the report, under investigation by legal experts, whose decision was then awaited before the claims were dealt with.

Water-Works at Baku.—The British Vice-Consul at Baku reports that the Russian Government have authorized the Baku Municipality to negotiate a loan of 26,500,000 roubles (about £2,797,000), bearing interest at 5 per cent., over a period of 49 years, for the purpose of bringing fresh water to the town.

ROCHDALE AND THE TEST BURNER.

The proposal of the Rochdale Corporation to amend by Provisional Order the Rochdale Improvement Act of 1872, so as to provide, in regard to the testing of gas, for the substitution of the "Metropolitan" No. 2 argand burner for that now in use, formed the subject of a Local Government Inquiry held at the Town Hall last Thursday.

The TOWN CLERK (Mr. W. H. Hickson), in his statement, pointed to the changes and improvements that had been made in gas manufacture and lighting, and added that it was not proposed to reduce the candle power to 14, as was now becoming common. The increased use of gas for heating, cooking, and motive power, and the extensive use made of the incandescent mantle, rendered calorific power more important to the consumer than illuminating power. The change of burner for testing would be of assistance to the Corporation in providing gas of higher calorific power at possibly slightly reduced expenditure.

Mr. BLOMLEY asked if the Order could abrogate an Act of Parliament.

Mr. F. J. WILLIS (the Local Government Inspector) replied that a Provisional Order had the same authority as an Act of Parliament.

Mr. BLOMLEY inquired if the Corporation could reduce the candle power by the Provisional Order to any minimum they liked.

The INSPECTOR replied in the negative; adding that there was no proposal to reduce the candle power, but only to alter the testing burner.

No further points were raised, and the inquiry closed.

INCREASED STORAGE AT BURNTISLAND GAS-WORKS.

Inauguration of a New Gasholder.

Last Thursday afternoon, a new holder, of 100,000 cubic feet capacity, which has been erected by the Barrowfield Iron-Works, Limited, of Glasgow, at the gas-works of the Burntisland Corporation, was inaugurated. The tank, constructed of mild steel, is 75 ft. 6 in. diameter, and 25 ft. 6 in. deep. The holder is 72 feet in diameter, and 25 feet high, and is on the Gadd and Mason spiral-guided principle. The cost of the holder and tank has been £1840. The work has been under the supervision of Mr. A. Ross, the Manager, who also did the excavation and the laying of the concrete foundation. The storage accommodation at the works is now 150,000 cubic feet. The need of a new holder will be apparent when it is stated that hitherto the storage capacity has been only 50,000 cubic feet, and that the maximum daily make has been 95,000 cubic feet. The provision is now so ample that there will be no longer any fear as to the supply of gas running short, as was the case last winter. It is estimated that, taking into account the extra demands for gas for cooking and heating purposes, the new holder will be sufficient to provide for the wants of the burgh for twenty years. There is reason for gratification that the cost of the holder will not add to the price of the gas.

The members of the Town Council met at the gas-works, and after a round of inspection, in which everything was found to be in a satisfactory condition, Mr. Ross called upon Provost Ferguson to turn on the gas. Provost Ferguson expressed the pleasure of the Town Council, as the Gas Commissioners, at seeing the new holder so efficiently and expeditiously completed, in time for the winter's necessities; but as the work had been mostly executed during the term of office of his predecessor, ex-Provost Wallace, he thought the opening ceremony should also be performed by him; and he chivalrously called upon that gentleman to turn on the gas. Mr. Wallace thanked the Provost and the Council for the honour thus conferred upon him, and expressed the hope that the new holder would relieve the anxiety which had been so often experienced during the winter months of there being a shortage of gas. This fear was now at an end; and the Contractors were to be congratulated on having made a most excellent job of the holder, and having carried it out within the specified time. Mr. Wallace then turned on the gas. Mr. Laidlaw, the representative of the Contractors, expressed the great satisfaction they had in completing their contract with the Commissioners, and referred to the kindly help and assistance they had received from Mr. Ross, the energetic Gas Manager, who had done much to help them to complete their work so expeditiously. He presented Mr. Wallace with a souvenir of the occasion in the shape of a bioscope and a piece of jewellery for Mrs. Wallace, remarking that it gave him great pleasure to do so, as the work had been carried out under the most pleasant conditions, and with perfect harmony and good feeling.

THORIUM NITRATE AND MONAZITE SAND.

[From the "Sunday Times."]

A few months ago we stated that the thorium and monazite market had been completely ruined. Since then prices have still further receded. Thorium nitrate, which two years ago was quoted at 53s. per kilogramme, a year ago at 32s., and last spring at 26s., is now dealt in at 22s. No improvement is in sight, for this article is manufactured by about a dozen competing firms, instead of four, as formerly. In addition, sales to the United States have ceased, for the duty has been raised from 25 to 40 per cent. There are large monazite deposits in the States, so that even at the present low European prices competition in America is practically impossible. The cause of this condition is the superfluity of monazite sand, which used to come exclusively from Brazil, where Mr. Gordon, an American, owned all the mines. Later on the Hamburg firm of A. C. de Freitas took over some monazite mines from the Brazilian Government. Finally, a Paris company obtained large monazite deposits in Brazil. In the result, there are 11,000 tons of monazite sand in Europe—sufficient for five years' consumption, or, if we exclude America, for seven years.

The Federal Government of Brazil some time ago imposed a 50 per

cent. tax on monazite sand. Mr. Gordon declined to pay this tax, and began an action at law. He recently won his case, and is now free of tax. The Paris company also began an action; and they have now so far won their case that they have to pay only a very small tax. This enables monazite sand to be exported cheaply. The cost of production of a ton of monazite, containing 5 per cent. thorium, is £7 to £8. To this must be added the tax, which, however, is only heavy for Messrs. de Freitas.

Two new big monazite deposits have been discovered within the last year—one in the North Transvaal, the other in German East Africa. The Transvaal deposits have so far not been worked, owing to transport difficulties, which, however, are being removed. The East African deposits are near Morogoro, which is just being reached by the railway, and where, consequently, work will now begin. A third deposit has recently been located in the Transvaal, where monazite sand is found in conjunction with tin. Monazite will be won as a bye-product.

The demand for monazite sand is limited. It is principally used for incandescent gas mantles; but this branch of manufacture is not progressing, owing to the competition of the electric metal incandescent lamps. The result is the decline of the thorium nitrate production. One large producer—an Austrian factory—has discontinued the sale of thorium owing to the low prices; and the largest concern, the Deutsche Gasglühlicht Company, in its last annual report, confirms the severe depression prevalent in the thorium industry.

LONDON COUNTY COUNCIL AND SMOKE ABATEMENT.

Proposed Amendment of the Public Health Act.

The London County Council have given notice of their intention to apply to Parliament next session for various powers; and the Bill to be promoted will contain a section dealing with the smoke nuisance. They will ask for the amendment and extension of section 24 of the Public Health (London) Act, 1891, and for the application of its provisions to chimneys sending forth smoke of any colour, and to define the expression "chimney" in the section (as proposed to be amended by the intended Act) as including any opening through which smoke is emitted from any building or place. The Council also wish to extend and apply all or some of the provisions of the above-named Act relating to smoke consumption and the abatement of the smoke nuisance (with such variations as may be specified in the Bill) to chimneys, fireplaces, and furnaces used in buildings or places in which operations are carried on under statutory powers, or which belong to, or are used by, the Crown, and to the premises in or upon which the same are used. Authority will be sought for the Council, at the request of any sanitary authority, to enforce or assist in enforcing (either by contributing to the cost of proceedings or by joining in or taking proceedings) all or any of the provisions referred to, as varied under the intended Act. The Council will also ask Parliament to extend and apply (if and so far as may be necessary) these provisions, or some of them, as varied to chimneys, fireplaces, and furnaces belonging to, or used by, sanitary authorities, and the premises in or upon which the same are used; and to empower the Council, whether by extending section 22 of the Act of 1891 or otherwise, to enforce and carry into effect the provisions against such sanitary authorities. Authority will be required for the Council to take proceedings in cases of nuisance from smoke arising outside the county; and to expend moneys in the investigation and advancement of measures for the abatement of the smoke nuisance.

THE SMOKE PROBLEM IN GLASGOW.

The attention which is being directed to the subject of the smoke pollution of the atmosphere in Glasgow, referred to in "Notes from Scotland" recently, has not been allowed to drop. There have been letters published in the "Glasgow Herald," a leading article by the Editor, special articles by Mr. Henry M. Sayers, M.Inst.E.E., and Mr. R. M. Neilson, A.M.I.Mech.E., and a discussion in the Town Council upon it.

As to the letters, they are, as letters which are mostly anonymous always are, somewhat erratic, though some of them—those which are signed particularly—contain information and ideas which are quite worthy of attention. The correspondence, in the earlier period, was remarkable for the unanimity with which the writers supported the view that the gas-stove is destined to play a large part in the improvement of the condition of the atmosphere. The repeated assertion of this view seems to have had the effect of bringing the advocates of electricity into the discussion, for there have been, within the last few days, several letters advocating the adoption of electricity for all household purposes. One writer suggests the use of gas for firing the steam-boilers in electric-stations; and his reflection upon the subject is quite refreshing. He states that "the first cost of using gas for this purpose would be higher than coal; but the saving in labour and the clearer atmosphere would repay us, and would help to solve the problem which will before long trouble our civic rulers, of 'what to do with our gas.'"

In one of the letters, signed by Mr. D. M. Stevenson, who is a coal merchant, has been in the Town Council for many years, a Magistrate of the city, the City Treasurer, and who is a member of the Gas Committee, it was stated that in 1898-99 he got the Corporation to establish and organize a Chemical Department. The two main reasons he gave for having a highly qualified chemist entirely at their disposal were: (1) The need for an expert to assist the Sanitary Department's efforts for the abolition of smoke and the purification of the atmosphere; and (2) the reduction of the loss involved in the purification of the river by the utilization of the manurial properties of the sewage. The Committee have, the writer goes on to state, pointed out again and again the advantages in this connection of using gas-fires and gas-cookers; and a large number of these are already in use, thanks to the efforts of the Gas Department. The improvements in these appliances have been so great in recent years that he considers it is time that the Corporation gave another exhibition of the latest inventions; and this would be proposed at the next meeting of the Gas Committee. He suggested to the late Mr. Foulis the desirability, when erecting the new works at Provan, of giving facilities to small manufacturers to establish works in the neighbourhood, to which power gas would be supplied at a low rate. He had called his successor's attention to the matter on various occasions; and last year he was instructed to look into the whole subject and report. He learned from him that he had gathered much information regarding it, which would be put before the Gas Committee on an early date.

In the leading article by the Editor, there is the startling reference to "the sixty or so tons of deleterious solids which some 1200 factory chimneys and innumerable domestic flues are daily shooting into our atmosphere." As an argument in favour of smokeless fuel, it would be difficult to find anything finer than the passage in which the writer states that: "By absorbing nearly all the actinic quality of daylight, smoke and fog deprive the body of the only possible antidote to their poisonous effects, and the vitality is still further reduced by the difficulty of keeping the person and apparel perfectly clean. The low bodily tone affects the mind, which, still further depressed by a dingy environment and the consciousness of surrounding squalor, not only reacts upon the body, but insidiously affects the moral sense by weakening the stimulus of optimism. And thus we have a vicious circle of enervating influences, which plainly reduce both the economic efficiency and the healthy joy of life, and which have certainly not a little to do with the resort of many of our people to pernicious or degrading excitements."

The special article by Mr. Sayers was entitled "Clean Industrialism—Forecast of a Smokeless Future." The writer condemned the use of raw coal, and went on to state that the fact that gas and coke can be burned smokelessly is a commonplace of three generations, but that it has not done very much yet towards replacing raw coal. The reasons why it has not done so are founded on the original idea of using coal gas as a convenient and even luxurious lighting fuel, and in the consequent statutory regulations for ensuring high illuminating power, low and regular supply pressure, and a high standard of purity in certain respects. Consequently, illuminating gas as supplied in cities and towns is not a cheap fuel, although a very clean and convenient one. He goes on to state that a gas manufacturer has no inducement to study the quality of the coke produced. It is gas that is wanted; and maximum gas production is not conducive to certain qualities valued in coke. Hence gas coke is of no value for foundry or blast-furnace purposes, and is not so good a domestic fuel as it might be made if it answered someone's purpose to do it. It is, he considered, to the modern coke-oven near the pit's month that the industrial city of the near future will owe its advantages of smokelessness and cleanliness. Mr. Sayers went on to state that the gas-engine is now a reliable and effective machine up to quite large sizes; and for a given consumption of coke-oven gas it will give out at least twice as much power as any set of steam boilers and engines. So the full power value can be got from gas-engines distributed electrically; and assuming a colliery coking the whole of its output, it was reasonably certain that the whole power needed for the colliery, on the surface and underground, could be supplied from the coke-oven gas. Therefore, on a colliery, no raw coal need be consumed nor smoke produced. The colliery output would then be coke; and with it the whole of the power, heating, and lighting might be produced electrically in factories, houses, and streets, as required. To the advantages of clean air and a smokeless sky would be added those of no coal dust, no ashes, and no ugly chimneys. If actual fuel were wanted for certain manufacturing operations, water gas, enriched if necessary, and supplied at an economical pressure, could be locally produced from the coke. He concluded that, "with a properly organized use of our existing resources on some such lines as indicated, it was quite possible that this country could be made and kept as good a place to live in as any part of the civilized world, and that its industries and activities might be purged of the greater part of the squalor, dirt, disease, and physical discomfort which now seem inevitably attached to them."

In the last Glasgow Town Council, a motion was submitted by Bailie Paxton, the Sub-Convener of the Gas Committee, proposing a remit for a report on the practicability of all Corporation departments being instructed to adopt in rooms and offices smokeless means of heating. After discussion, in which the merits of heating by gas were favourably commented on, the motion was adopted.

THERMAL VALUES OF COAL, GAS, AND ELECTRICITY.

There appeared in the "Glasgow Herald" on Monday of last week the following article by Mr. R. M. Neilson, A.M.I.Mech.E., written in view of the smoke abatement discussion.

The argument is often put forward that coal in a domestic fire-place is most wastefully burned. Grates vary among themselves. Some types are such bad agents for room-heating purposes that it is difficult to imagine how they have been evolved; others are very much better, and reflect great credit on their designers. Gas and electricity lend themselves to a more efficient use for house heating and cooking purposes—especially the latter. It is not the purpose of this article to discuss the design of coal-fires, gas-stoves, or electric radiators, or even to sum up the advantages and disadvantages of them, but to deal with only a small portion of the subject—a portion, however, about which there appears to be much want of knowledge, if not misconception. Leaving aside cooking and other special domestic heat-consuming operations, which require more elaborate treatment, it is desired, firstly, to point out how much more efficiently must coal gas and electricity respectively be used than coal before each can, at present prices, compete with coal in point of cost for house-warming purposes.

A special correspondent of the "Glasgow Herald" has written three articles upon the subject, and sums up with the remark that it appears to him that the problem of smoke abatement in the city is

capable of practical solution in the following ways, consistent with reasonable economy: (1) For steel and iron manufacturers and large steam users for power purposes, the manufacture and use of producer gas; (2) for moderate steam users and for all heating in comparatively small establishments, the use of Corporation gas at a flat-rate of not more than 1s. 8d. per 1000 cubic feet, or for power purposes alone, electrical energy at a flat-rate not exceeding 0·67d. per kilowatt hour; and (3) for cooking purposes and for domestic and office warming, Corporation gas or other gaseous fuel at a flat-rate of not more than 1s. 4d. per 1000 cubic feet. Under these conditions, the writer considered, the authorities should be able to abolish the practice of burning raw coal, or at all events have power to compel all coal users to keep a smokeless chimney top. The Sub-Committee on air purification of the Corporation Health Committee had before them on a recent occasion a report by Mr. F. W. Harris, the Corporation Analyst; Mr. P. Fyfe, the Sanitary Inspector; and A. Wilson, the Gas Engineer, on the effect which a more general adoption of gas-firing in dwellings and premises in the city would have on the atmosphere. The report was altogether favourable to the use of gas, in respect of efficiency, cleanliness, and cost. The report is to be submitted to the Corporation. Mr. D. M. Stevenson has given notice in the Gas Committee of his intention to move "that, with a view to the diminution of the smoke nuisance, it be remitted to the Sub-Committee on the Hire and Sale of Gas-Stoves to make arrangements for the holding of an exhibition for the purpose of showing the public the most up-to-date appliances for the utilization of gas for heating, cooking, and shop-lighting purposes, and that the Electricity Committee be asked to co-operate."

Comparative Statistics.

Table I. gives in the first column the cost of coal in shillings per ton, and in the second column the corresponding number of British thermal units contained in a pennyworth of coal. The coal has been taken as having a heat value of 13,000 B.Th.U. per pound. Coal, of course, varies in thermal value; if it is desired to consider the case of coal having a thermal value greater or less than 13,000, a modified table can easily be constructed.

TABLE I.—THERMAL COST OF COAL.

Cost of Coal per Ton.	B.Th.U. per Penny.
10 shillings	243,000
14 shillings	173,000
18 shillings	135,000
22 shillings	110,000
26 shillings	93,000

Table II. corresponds to Table I., but refers to coal gas. The first column gives the cost in cubic feet, and the second column the heat units obtained for a penny. The gas has been assumed to have a calorific value of 600 B.Th.U. per cubic foot.

TABLE II.—THERMAL COST OF COAL GAS.

Cost of Gas per 1000 Cub. Ft.	B.Th.U. per Penny.
1s. 0d.	50,000
1s. 6d.	33,333
2s. 0d.	25,000
2s. 6d.	20,000
3s. 0d.	17,500

Table III. refers to electricity, and is self-explanatory.

TABLE III.—THERMAL COST OF ELECTRICITY.

Cost of Electricity per B.T.U.	B.Th.U. per Penny.
¾d.	4567
1d.	3425
1½d.	2283
2d.	1712
3d.	1142
4d.	856
6d.	571

It will be seen that, in order that heating by coal, gas, and electricity respectively may be equally costly, the heating by coal must be extremely inefficient. Comparing, for example, coal at 22s. per ton with gas at 2s. per 1000 cubic feet, and electricity at 1½d. per unit, it will be seen that the heat value of a pennyworth of coal is 4·4 times as great as that of a pennyworth of gas, and 48 times as great as that of a pennyworth of electricity.

For cooking—or, at least, in certain cooking operations under certain conditions—and for some other domestic purposes, the waste with a coal-fire, considering the heat from the latter as wasted except as far as it is utilized for the particular purpose in question, may be enormous; and gas often, and electricity occasionally, may be advantageously employed for reasons of pure economy, as well as for convenience. Such cases are not, however, being considered. For house warming purposes it will be seen that the efficiency of a coal-fire must, at the prices assumed, be only 2 per cent. of that of an electric radiator, and only 23 per cent. of that of a gas-stove, to have equal running costs.

To express much the same idea in other words, it may be said that if the coal, gas, and electricity were made to produce their heat under similar conditions, the cost of the electric heating would be about fifty times, and that of the gas heating between four and five times as great as that of the heating by coal. It may be said that this statement is not confirmed by practice. The figures, however, are indisputable; but in practice the conditions are usually not the same in the case of the three heating agents. There is generally much more ventilation with a coal-fire than occurs when gas or electricity is employed. The same ventilation could be obtained with either of the two latter; but the cost of doing so is usually grudged. The hygienic question cannot be discussed here.

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Future of Gas.

The next question to be considered in this article is that of the possibilities in the future. Coal will probably never fall in price much below—though it may rise above—the average of the last few years. What can be expected as regards reduction in cost of gas and electricity? The gas obtained from coal by the usual process adopted in gas-works contains about 15 to 25 per cent. of the heat units contained in the coal. For example, in the Glasgow Gas-Works in the working year 1908-09, 10,000 cubic feet of gas were made, and 9000 cubic feet sold, per ton of coal carbonized; and the calorific value of Glasgow gas is about 600 B.Th.U. per cubic foot.

Moreover, the coke which is left in the retorts after the gas has been driven off—*minus* that portion of the coke which is thereafter required for firing the retorts—has a thermal value equal to about 40 to 50 per cent. of the original thermal value of the coal. The process of coal-gas manufacture is, therefore, good from a thermal point of view, as comparatively little heat is wasted. The price of coal gas is, however, determined not only by the necessary thermal losses in the manufacture, but also by the labour and plant required in the manufacture, purification, and distribution of the gas. There are possibilities in the matter of reduction in the price of gas due to lowering these expenses; and, as is well known, the price of gas has been gradually coming down. If the expenses of manufacture, distribution, &c., could be reduced till they were covered by the receipts obtained from the coke and other bye-products, then the 9000 cubic feet of gas which are available for sale for every ton of coal carbonized could be sold for the price of the coal—viz., 11s.—that is, at the rate of 1·2s. (say, 1s. 3d.) per 1000 cubic feet.

Whether coal gas can ever be sold in the district at this price may be questioned; but it would certainly be foolish to hope for any reduction much below this figure. If, however, coal gas, having a thermal value of about 600 B.Th.U., could be sold at 1s. 3d. per 1000 cubic feet, 40,000 B.Th.U. would be obtained for a penny—the gas on a calorific basis being thus only 2·75 times as dear as coal at 22s. a ton, or 3·37 times as dear as coal at 18s. a ton—and, with the greater adaptability of gas, the latter could probably be substituted very effectively for coal for the heating of rooms. In the matter of cooking and for certain other domestic work, gas has, of course, special advantages over coal, which it is not the purpose of this article to deal with.

Electrical Possibilities.

Now consider the case of electricity. In the production of electricity in steam electric-power stations, the heat energy in the coal is employed to generate steam, which is then employed to operate engines—now usually steam-turbines—which drive electric generators, which, in their turn, supply electric current. Before, however, this electric current is given to consumers, it is frequently transformed to a lower pressure. To obtain heat from the electric current, the latter is passed through an electric radiator.

All these processes involve loss, even if the plant and appliances have good efficiencies. Some modern electric-power stations are run very efficiently; but the inherent losses during the several steps or energy-conversions are such that, even with the best plant, most economically worked, only a small fraction of the original heat energy in the coal appears again as heat in the radiator.

A steam-boiler at the best cannot be expected to generate more than about 9 lbs. of steam per pound of coal of (say) 13,000 B.Th.U. thermal value; and from each pound of steam only about 400 B.Th.U. could be converted into useful work in a steam-turbine, even if there were no loss whatever in the latter, and 250 B.Th.U. would represent very good practice. Therefore, we cannot expect the electric generator to receive more than $\frac{9 \times 250}{13{,}000}$ = about 17 per cent. of the heat energy of the coal; and we have further losses in the generator, the mains, and the radiator, and possibly also a substantial loss in conversion to a lower electrical pressure, to allow for. We cannot, therefore, at the very best, expect to obtain more than about 10 per cent. of the heat value in the coal to be given off as heat in the electric radiator.

As a matter of fact, the Glasgow Electricity Department the last working year used 5·25 lbs. of coal per B.T.U. of electricity sold (this coal consumption comparing favourably with other electrical undertakings). A unit of electricity is equivalent to about 3425 B.Th.U.; so that, if the coal had a thermal value of 12,000 B.Th.U. per pound, the heat obtained from an electric radiator would be less than 5½ per cent. of the heat in the coal used to produce the electricity. It will be seen from this that, even if the costs in connection with the generation and distribution of electricity could be considerably reduced, electric house-warming would still be extremely expensive compared with house-warming by coal.

Table IV. gives a comparison of gas and electricity, based on the last annual reports of the Glasgow Gas and Electricity Departments.

TABLE IV.—THERMAL COMPARISON BETWEEN COAL GAS AND ELECTRICITY.

	Electricity.	Gas.
Coal to produce 1000 B.Th.U. (lbs.)	1·53	0·417
Cost of the coal (pence)	0·073	0·0245
Thermal value of the coal (B.Th.U.) . . .	18,400	5420
Percentage of heat of this coal which appears in electricity or gas (per cent.)	5·45	18·5

[In gas manufacture there is, of course, also the large heat value in the coke to be taken into account.]

It will thus be seen that, while gas offers good prospects of taking the place of coal for house-warming purposes, the employment of electricity for such uses must always be very expensive; and electric heating, though useful in special cases, will never be sufficiently economical to justify its extensive use.

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PORTSMOUTH WATER COMPANY.

The Railway Spring Litigation.

The Half-Yearly General Meeting of this Company was held last Thursday—Mr. W. GRANT, J.P., in the chair.

The report presented showed that the revenue for the six months ended the 30th of September was £37,946, and the expenditure £14,989; leaving £22,957 for transfer to the profit and loss account, bringing it up to £28,303. Full statutory dividends were recommended, the payment of which would leave £8676 to be carried forward. There had been the usual extension of street service mains and of consumers; making a total of 63¾ miles of trunk mains, 162¼ miles of service mains, and 49,671 premises under constant supply.

The CHAIRMAN, in moving the adoption of the report, expressed regret at the recent death of Sir John Baker, one of the Directors. Referring to the new filtration and service reservoirs, which the Directors had every hope would be completed by the 31st of December, in compliance with the terms of their Act of 1906, he said they had already paid £54,500 out of the contract price of £73,000. The works were making excellent progress; and they believed the extras would be only a very moderate sum. As to their action against the London, Brighton, and South Coast Railway Company,* on which Mr. Justice Parker had reserved judgment, in regard to the right to a certain spring at Bedhampton, they had already paid £750; but the shareholders must not think the matter was now settled, though if they obtained judgment in their favour the Railway Company would have to pay a large proportion of their costs. They had also had to provide a steel main sewer and make other provisions at their Bedhampton works to conduct the surplus water along the Hermitage stream, where the flow from the hilly surrounding country had been no less than 270 million gallons in 24 hours. But the work was imperative for the purity of their springs.

The DEPUTY-CHAIRMAN (Colonel C. Lanyon Owen, J.P.) seconded the motion.

Mr. BALL hinted that some remuneration ought to be made to Mr. Ashley, the Engineer, for his design of the filtration scheme.

The CHAIRMAN pointed out that, though the Directors were not unwilling to recognize the services of Mr. Ashley, the plans of the latter had at the outset been submitted to Mr. Charles Hawksley.

The motion was carried unanimously; and the usual complimentary vote of thanks to the Chairman, Directors, and staff brought the proceedings to a close.

* A report of the case will be found in our "Legal Intelligence."—ED. J.G.L.

Owing to a breakdown at the borough electricity works yesterday week, a great part of Woolwich was plunged in darkness at about 7.30 in the evening. All the street-lamps were extinguished, and many business premises had to be closed.

NOTES FROM SCOTLAND.

From Our Own Correspondent.

Saturday.

In the Glasgow Town Council on Thursday, the Gas Committee reported that, at a meeting of the Committee on the 19th inst., Mr. D. M. Stevenson moved that, with a view to the diminution of the smoke nuisance, it be remitted to a Special Committee to make arrangements for the holding of an exhibition for the purpose of showing the public the most up-to-date appliances for the utilization of gas for lighting, heating, and cooking purposes, and that the Committee on Electricity and the Sub-Committee on Air Purification be invited to co-operate. The Committee approved of Mr. Stevenson's motion, and recommended that the Special Committee should consist of 15 members—six from each of the Gas and Electricity Committees, and three from the Committee on Air Purification. In the Town Council, Mr. M. W. Montgomery moved the approval of the minute. He stated that the question of air purification had excited great interest among the citizens, and the recent visitation of fog had increased it to a considerable extent. He hoped the Corporation shared this interest, because it was to the Corporation that the community looked very largely for the solution of the problem. They proposed to hold an exhibition somewhere in the centre of the town, where they would have a display of all kinds of exhibits and appliances for smokeless fuel. The Corporation would agree, he thought, that such a display was desirable. There could be no doubt that a great deal of information could be supplied on this question, which at present was not available to the citizens. He did not think that the expense would amount to much. In any case, they proposed to divide the expense between the Gas and Electricity Committees. Indeed, he did not think the expense would amount to very much more than the gas and electric current they would require for the display. He was quite sure that an exhibition of this kind would go far to solve many of the questions which were at present occupying a place in the Public Press and in public discussion elsewhere. It was said there was great rivalry between the Gas and Electricity Committees. He hoped there was, because only by such rivalry could they obtain the best results on the question. Mr. D. M. Stevenson, in seconding, suggested the deletion of the words "for the utilization of gas." Correspondence in the newspapers showed that there were possibilities in the use of anthracite and Coalite which were worthy of consideration, and they should be free to adopt suggestions. The minute was adopted. Treasurer Graham agreed that something should be done to try to diminish the smoke nuisance; but he thought that the fog of the previous week, and the difficulty of getting gas, had put the question back for a considerable time. He had heard of people having to dispense with gas-fires because of the insufficiency of the supply of gas.

Lord Salvesen, in the Court of Session yesterday, gave his decision in counter-actions relating to a gas-engine, which contained so many points that to recount them all would require more space than the

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NOT ***Nominal*** RADIATION—

BUT ***Effective*** RADIATION!

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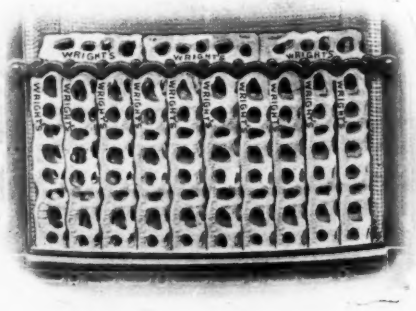

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218.

question at issue is worth for readers of the "JOURNAL." The engine was by a M. Catteau, a Frenchman. In 1904, Mr. Hubert Graham, who had had considerable experience with gas-engines, entered into negotiation with Messrs. D. Stewart and Co. (1902), Limited, of Glasgow, for the manufacture and sale of the engine in the United Kingdom. A 12-H.P. engine was subjected to certain tests with the view of satisfying Messrs. Stewart of the merits of the invention; and these resulted in two agreements being entered into. Under the one Messrs. Stewart acquired the right to the patent rights in the United Kingdom, and under the other Motor Plants, Limited, of London, whose business, Lord Salvesen said, was substantially conducted by Mr. Graham, were appointed agents for the sale of the engines. In the leading action, Motor Plants, Limited, sued Messrs. Stewart and Co. for £15,000 as damages for breach of contract; and in the counter-action Messrs. Stewart sued Motor Plants, Limited, for £3960 as the price of engines supplied to Messrs. Derry and Toms, of Kensington. As his Lordship read the record, the claim of the pursuers in the leading action seemed to be made on the footing of there having been a continuous breach of contract, resulting, as was now alleged, in such loss to the pursuers that they were ultimately forced into liquidation. It was true, Lord Salvesen said, that Catteau engines had been commercially successful on the Continent; but all these engines were of small size, and not such as the defenders in their agreement with the vendors of the patent ever proposed to manufacture, and there was no evidence at all that Catteau engines above 35 H.P. had been made which had been commercially successful. That loss and disappointment were caused to both during the subsistence of the agency was manifest; but, so far as the pursuers were concerned, it seemed to have been mostly due to their own unbusiness-like conduct, and to the ultimate failure of the Catteau engine to fulfil the expectations which the patentees cherished. Lord Salvesen arrived at the conclusion that the pursuers (Motor Plants, Limited) had failed to prove a single instance in which the defenders had failed to implement any contract which they made with the pursuers. In the leading action, he therefore gave Messrs. Stewart absolvitor. In the counter-action, in respect that one of the four engines had been taken back by Messrs. Stewart, he deducted the price of it—£865; and making a deduction of £300 for parts of another engine undelivered, he gave decree for £2735. Messrs. Stewart were found entitled to expenses in both actions.

The Gas Committee reported to the Falkirk Town Council last week that an offer had been received for the site of the old gas-works. The subject was remitted to the Committee for consideration. Bailie Dillon said he regretted very much to have recourse to such a step as to make a public statement in regard to being almost insulted at that Board through one of their officials. They were discussing the reduction of the staff at the gas-works, and the Engineer said he could not do without a certain man, as was proposed by some members who were good authorities. A member of the Committee said that if Mr. Wilson had made such a statement there was no use discussing it; but he thought differently, because he said that Mr. Wilson had made a statement before that a number of men could not be done without at the gas-works, and when a Committee had been appointed to investigate the matter, the staff had been largely reduced. Mr. Wilson then jumped up and called him to order. He left it to them to decide if it were the thing for any member of the Council to be treated so by an official, especially when that member was making a true statement. He did not wish to make matters worse, but the Chairman—Bailie Bogle—called him to order also. He retorted; and the Chairman told him to sit down. Provost Christie said he saw the matter referred to in the Public Press, and thought it his duty to inquire if such a thing had occurred. He was told that it had happened that an official so far forgot himself at the moment that he certainly almost involuntarily jumped up and used the words that Bailie Dillon had said. But he was also informed that the official in question apologized. If this were the case, he took it that Bailie Dillon was satisfied. Bailie Dillon said he was quite satisfied. Dean of Guild Neilson thought it most unfair that such explanations should be allowed to be made without any member being permitted to make a statement in defence of the official. Bailie Dillon made the statement that the Gas Manager had said there were 27 men he could not do without. There was no doubt that there were 27 men less last year than the year before; but that was because those men were required to handle coke at the works, on account of the coke-conveyor having broken down. The Manager, on his own recommendation, got the furnace altered for the handling of this coke; hence the reason that he could do with 27 men less. There was a limit to the patience of any official; and he did not blame the Gas Manager for losing his head when that statement was made by Bailie Dillon.

I mentioned last week that the Kirkcaldy Town Council had passed the second resolution in favour of the adoption of the Burghs Gas Supply Act of 1876. In moving the resolution, Mr. Wright said that the matter had been before the ratepayers for twelve months, and the consensus of opinion was that the Council were taking the right course in acquiring the gas-works. They had had no opposition in Kirkcaldy to the acquiring of the gas undertaking with one single exception, which emanated from the Town Council, and which, in his opinion, was founded upon the erroneous view that the price would be fixed upon a 28 years' purchase. This was an antiquated notion. That mode of valuation was tried in Dunfermline. On the basis of it the price was given as £149,000; whereas the award of the Arbiters was only £80,000. In Falkirk, on the same principle, the price was made out at £115,000; whereas the Arbiters' calculation came out at £77,000. They did not know what the price in Kirkcaldy would be. They could only judge by what had been done in other towns. He based his whole case upon the fact that there was a good paying business in Kirkcaldy; and any increase there might be in the consumption of gas would be entirely profit. He did not say that they would be able at once to reduce the price of gas; but, judging from experience in other towns, they would not have to come on the rates to support the gas undertaking. Mr. Mackinnon repeated his dissent to the adoption of the Act. His argument was founded on the 28 years' purchase only. He calculated that the maintainable profits being £4528, at 28 years' purchase, with 10 per

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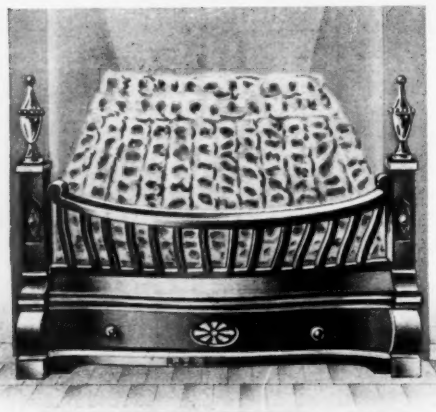

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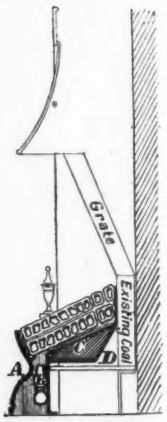

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cent. added for compulsory purchase, the cost of the undertaking would amount to nearly £140,000. There was very little difference between the maintainable profits and the interest to be paid on the borrowed money necessary to the purchase. As to the case of Dunfermline, he had already pointed out that there the works were entirely new; whereas the works they were asked to acquire in Kirkcaldy were eighty years old, and, looking to the accounts of the Kirkcaldy Gaslight Company, they would find that it took, year in and year out, something like £3500 to keep them in repair and renewal. The share capital of the Kirkcaldy Company was about £65,000, while the Dunfermline Company's share capital was £50,000; yet, before Dunfermline could acquire the gas-works, it cost them upwards of £100,000. In Kirkcaldy, on the same principle, the figure would be about £130,000, and, with nearly £10,000 for depreciation and maintenance funds, they would find that the sum of £140,000 was very near the mark. Mr. Mackinnon did not move disapproval of the resolution; and it was consequently adopted.

CURRENT SALES OF GAS PRODUCTS.

LIVERPOOL, *Nov.* 27.

Sulphate of Ammonia.

At the commencement of the week the same dull tone was still apparent in the market; but towards the close there was more buying, which brought about a somewhat better feeling, and to-day's values are £11 2s. 6d. to £11 3s. 9d. per ton f.o.b. Hull, £11 3s. 9d. to £11 5s. per ton f.o.b. Liverpool, and £11 5s. to £11 6s. 3d. per ton f.o.b. Leith. Manufacturers have evidently not been quite so firm in their views as regards making sales in the forward position, and it is reported that a considerable amount of business has been done for delivery January-June next year at £11 7s. 6d. per ton f.o.b. shipping ports.

Nitrate of Soda.

There is rather more pressure to sell this article; but so far holders maintain spot quotations at 9s. 3d. per cwt. for ordinary, and 9s. 6d. for refined quality.

LONDON, *Nov.* 29.

Tar Products.

There has been little alteration in the market for tar products during the past week. Pitch remains steady, and there has been very little further business reported. Buyers do not seem particularly keen to purchase, especially at the prices at present being asked by makers. Creosote is quiet. The demand for solvent naphtha for forward delivery and prompt is particularly good.

The average values during the week were: Tar, 13s. to 17s., *ex* works. Pitch, London, 26s. to 26s. 3d.; east coast, 25s. 3d. to 25s. 9d.; west coast, 24s. to 25s. f.a.s. Mersey ports, 25s. f.o.b. other ports. Benzol, 90 per cent., casks included, London, 6¼d. to 6⅝d.; North, 5⅝d. to 6d.; 50-90 per cent., casks included, London, 7½d.; North, 7d. Toluol, casks included, London, 9¾d. to 10d.; North, 9d. to 9¼d. Crude naphtha, in bulk, London, 3¾d. to 4d.; North, 3½d. to 3¾d.; solvent naphtha, casks included, London, 1s. 0¼d. to 1s. 1d.; North, 11½d. to 1s.; heavy naphtha, casks included, London, 10½d. to 11½d.; North, 10d. to 10½d. Creosote, in bulk, London, 2⅛d. to 2⅝d.; North, 2d. to 2¼d. Heavy oils, in bulk, 2⅝d. Carbolic acid, 60 per cent., casks included, east coast, 10½d. to 10¾d.; west coast, 10½d. to 10⅝d. Refined naphthalene, £4 10s. to £8 10s.; salts, 40s. to 42s. 6d., packages included and f.o.b. Anthracene, "A" quality, 1½d. to 1⅝d. per unit, packages included and delivered.

Sulphate of Ammonia.

There is practically no change in this article, although in some quarters it is found that dealers are paying considerably higher than the stated marked prices. This is probably covering in for the month, as prompt sales could not be made at such figures. To-day, the actual Beckton quotation is £11 5s.; and for January-June, £11 8s. 9d. Ordinary makes upon Beckton terms are £10 18s. 9d. In Hull, the figures quoted are £10 18s. 9d. to £11; and in Liverpool, £11 to £11 1s. 3d. In Leith, £11 5s. is asked, and for January-June, £11 8s. 9d.

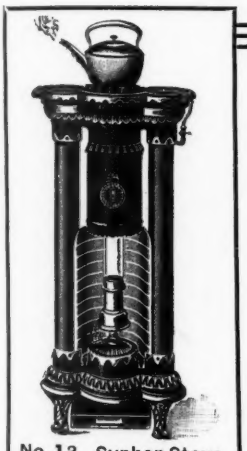
COAL TRADE REPORTS.

Northern Coal Trade.

A rather better demand is experienced in the coal trade of the North; and with steamers arriving more freely, there have been fuller shipments. In steam coals, best Northumbrians are from 10s. 3d. per ton f.o.b. Second-class steams are 9s. to 9s. 3d.; while steam smalls are not so abundant at from 5s. to 6s. The output of the collieries is not quite at its heaviest, and thus is well taken up. In the gas coal trade, the demand is now a very full one, and the deliveries on the long contracts are large, especially of the best classes. Durham gas coals vary in price. For the usual kinds, from 10s. to 11s. per ton f.o.b. is quoted, according to quality; and for best "Wear specials," about 11s. 6d. is the current quotation. The tenders for the supply of Gothenburg for next year are placed. The quantity is about 25,000 tons, and the price for second-class gas coal is believed to be equal to about 10s. per ton f.o.b. Tenders are also asked for some 120,000 tons for Stockholm's gas supply for next year, which tenders will be received up to Dec. 6. A contract has also been booked for a small lot of "Wear special" gas coal for export at a price which should leave about 11s. 3d. per ton f.o.b. Coke is firm; and gas coke, though in heavy output, is steady at from 12s. 6d. to 13s. per ton f.o.b.

Scotch Coal Trade.

The severe weather led to an improved demand for coal; but the fog which was experienced in the west greatly interfered with transit, and neutralized the improvement. Foreign orders are fairly satisfactory. The prices now quoted are: Ell 9s. 3d. to 10s. 6d. per ton f.o.b.



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CLARK'S PATENT HYGIENIC

"SYPHON" RADIATORS

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REQUIRE NO FLUE.

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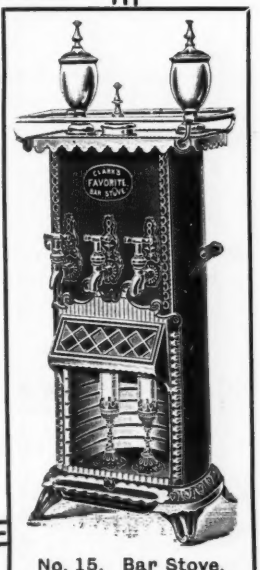

No. 15. Bar Stove.

Supplied to
H.M. The King,
Her late Majesty Queen Victoria,
H.R.H. The Duke of Connaught,
H.M. Board of Works,
The Houses of Parliament,
&c., &c.

Glasgow, splint 10s. to 10s. 3d., and steam 9s. to 9s. 3d. The shipments for the week amounted to 296,039 tons, a decrease of 18,252 tons upon the previous week, but an increase of 9936 tons upon the corresponding week of last year. For the year to date, the total shipments have been 13,720,349 tons—an increase of 627,183 tons upon the corresponding period.

Producer Gas for Pumping Sewage.—We learn from the Engineering Supplement to "The Times" that, on the advice of their Surveyor (Mr. G. W. Lingwood), the Joint Committee, of the Stowmarket Urban and East Stow Rural District Councils have decided to instal a gas-producer at their sewage-pumping station to supply an engine which has hitherto been working on coal gas.

Auto-Lighter, Limited.—This Company was registered on the 20th inst., with a capital of £10,000 in £1 shares. It is a private Company; and its objects are to purchase or otherwise acquire and take over the British patents relating to the invention of George Robson for automatically turning on and off the lights of gas-burners and the apparatus therefor, and any subsequent improvements upon same, &c., and to enter into an agreement with the Pressure-Clock Lamplighter, Limited.

New Joint-Stock Companies.—The Cedford Gas Process Company, Limited, has been registered with a capital of £5750 in 5000 £1 shares and 15,000 1s. shares, to enter into an agreement with C. E. Williams, F. Bedford, and E. Erdmann. It is a private Company. The Merlin Gas and Engineering Company, Limited, has been registered with a capital of £1000, in £1 shares, to carry on the business of ironfounders, mechanical engineers, manufacturers of machinery, &c. This is also a private Company.

The Resignation of the Town Clerk of Brighouse.—At the close of the business at the monthly meeting of the Brighouse Town Council, the Mayor (Alderman Robert Thornton) referred to the fact that it was the last occasion on which the Town Clerk (Mr. James Parkinson)—who until recently also occupied the position of Gas Engineer—would be present in that capacity. Mr. Parkinson had served the borough for over thirty years, which was a long time in a man's life. He (the Mayor) felt sure that he would voice the feeling of every member of that Council when he said that they wished to tender to him their best wishes for his future welfare. Other members having spoken in the same strain, Mr. Parkinson said he had slaved for the town, and no effort of his had been wanting to promote the good of the community. When he went to Brighouse in 1878, gas was sold at 3s. 4d. per 1000 cubic feet. By 1892, the price had been reduced to 2s. 2d.; and then he was told that he had no ability to manage a gas-works. He had given the best years of his life to the town; and now, at nearly sixty years of age, he was turned out into the street. He had been in this business most scandalously used, and most unjustly accused. When he was before the Gas Committee, he told them that he knew nothing of what had been going on wrong in any shape or form.

Crickhowell Gas-Works Sold.—Some days ago, the Crickhowell Gas-Works, established over 50 years ago by the late Mr. William Christopher, were sold at auction by Mr. Thomas Lewis for £1400; the purchaser being Mr. William Williams, of Crickhowell.

A Dangerous Emetic for "Gassed" Persons.—An inquest was held at Crewe last week on the body of Samuel Dean, a London and North-Western Railway gas inspector. It appeared from the evidence that he was fixing a gas-meter when there was a slight explosion. He afterwards complained of gas poisoning, and lapsed into unconsciousness, and died. It was further stated that it was the custom of gas men when poisoned to take ginger beer as an emetic; and Dean drank a bottle after the explosion. Dr. Hodgson, who made a post-mortem examination, said this was the worst possible emetic. It increased the tension of the blood, instead of decreasing it. The Home Office advised oxygen. Death was caused by rupture of a blood vessel on the brain, due to disease of the cerebral artery, but accelerated by carbon monoxide poisoning. The Jury returned a verdict accordingly.

Sales of Stocks and Shares.—At the Mart, Tokenhouse Yard, E.C., last Tuesday, Messrs. A. & W. Richards placed some further issues of new capital, in accordence with instructions received from Directors. The first lots consisted of an issue of £4085 of consolidated ordinary stock of the Worthing Gas Company, carrying 5 per cent. dividend from the 7th prox.; and it was all sold at from £102 10s. to £103 5s. per £100. Some £10 ordinary shares (7 per cent.) in the Bognor Water Company were next offered, and were all sold at £16 to £16 7s. 6d. each. A large issue of £32,000 of 4 per cent. perpetual debenture stock of the Alliance and Dublin Consumers' Gas Company realized from £95 to £99 per £100. Next day, Messrs. King and King sold two £50 "C" shares in the Portsea Island Gas Company, carrying 12 per cent. dividend, for £124 10s. apiece; and some £5 shares (7 per cent.) in the Portsmouth Water Company at prices ranging from £8 7s. 6d. to £8 10s. each. At a recent sale, 400 new "C" shares in the Littlehampton Gas Company, limited to 5 per cent. dividend, were sold at an average price of £5 18s. 9d. each. At the Duke of York Hotel, York Town, Messrs. Sadler and Baker offered for sale 470 additional ordinary shares of £10 each in the Frimley and Farnborough Water Company. Competition was brisk; and the shares were all disposed of at a satisfactory premium—the prices varying from £15 12s. 6d. to £15 17s. 6d. per share. The total amount realized was £7368 15s.; being an average of £15 13s. 6¾d. per share.

After discussion in committee, the Bilston Urban District Council have decided to accept an offer of the local Gas Company to illuminate the Market Hall under a contract for ten years. The hall is at present lit by electricity.

Last week's fog brought about a greatly increased consumption of gas in Manchester. On Tuesday, 24,870,000 cubic feet were measured out; the normal consumption at this period of the year being about 22,000,000 feet per day.

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Sawer & Purves,

MILES PLATTING,
MANCHESTER.

RADFORD ROAD,
NOTTINGHAM.

Scotch Agent: JNO. D. GIBSON, 2, Causeyside Street, Paisley.

At to-morrow's meeting of the Manchester City Council, Mr. Jennison will revive his resolution on the price of gas to penny-in-the-slot consumers. In effect, his motion is that the same price be charged to such customers as that obtaining for quarterly consumers.

At the meeting of the London County Council last Tuesday, the Main Drainage Committee reported, in regard to the supply of proto-sulphate of iron to the Barking outfall, that it would be to the advantage of the Council to accept the tender of the Gaslight and Coke Company, as, though it was 1s. 3d. a ton higher than the lowest tender, the Company proposed to supply the chemical in solution in tanks direct to the works instead of in crystals, with the result that the Council would save the cost (1s. a ton) of unloading the crystals from barges into store, and also the expense of dissolving the material before it is added to the sewage. It was agreed that the Company's tender for 3300 tons, at 18s. a ton, should be accepted.

Messrs. Firth Blakeley, Sons, and Co., Limited, of Thornhill, Dewsbury, have recently completed at Warrenpoint a new gasholder 45 feet diameter by 16 feet deep and steel tank 46 ft. 6 in. diameter by 16 ft. 6 in. deep. The holder has been working since Sept. 30 without a single hitch, and has been most satisfactory to the Company and to the Engineer (Mr. Gibson), to whose instructions the work was carried out. At Tullamore, a double-lift gasholder and steel tank were taken in hand. The inner lift is 40 feet diameter and the outer lift 42 feet; both being 16 feet deep, with steel tank 44 ft. 6 in. by 16 ft. 6 in. deep. This order was carried out successfully under the supervision of the Manager (Mr. F. T. Eustace), but to the instructions of Mr. W. F. Cotton, of Dublin. A contract with the Renton Gas Company for converting an existing columnless gasholder into a standard-guided one has also been completed in a perfectly satisfactory manner, and in a short time, under Mr. Frank Carlow, the Manager of the works.

WANTED, FOR SALE, CONTRACT, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Situations Vacant.

DRAUGHTSMAN. W. J. Jenkins and Co., Retford.
GAS STOVE TRADE. No. 5159.
WORKING MANAGER (FAZAKERLEY GAS-WORKS). Applications by Dec. 13 to Liverpool Corporation.

Situation Wanted.

HOUSEKEEPER (Daughter of a Gas Engineer). No. 5156.

Agencies.

GAS INCANDESCENT LIGHT MANUFACTURE ANKER, Adalbertstrasse, 94, Berlin.
INVERTED GAS BURNERS. No. 5158.

Plant, &c. (Second-Hand), for Sale.

COMPLETE GAS-WORKS, &c. Mr. Henry Gibbings, North Tawton, Devon. Tenders by Dec. 20.

Stocks and Shares.

BRENTFORD GAS COMPANY. Dec. 15.
HARROW AND STANMORE GAS COMPANY. Dec. 7.
LOWESTOFT WATER AND GAS COMPANY. Dec. 7.
SOUTHEND WATER COMPANY. Dec. 7.

TENDERS FOR

Fire-Clay Goods.

NOTTINGHAM GAS DEPARTMENT. Tenders by Dec. 4.

General Stores—

(Cocks, Meter Boxes, Castings, Retort Fittings, Scrap Iron, Brass, &c., Iron and Steel, Lime, Paints, Oils, Tools, Lead Lead Pipe, &c., &c.)
NOTTINGHAM GAS DEPARTMENT. Tenders by Dec. 4.

Oxide.

RADCLIFFE AND PILKINGTON GAS COMPANY. Tenders by Dec. 3.

Meters.

NOTTINGHAM GAS DEPARTMENT. Tenders by Dec. 4.

Pipes, &c.

NOTTINGHAM GAS DEPARTMENT. Tenders by Dec. 4.

Tar and Liquor.

SHOTLEY BRIDGE AND CONSETT GAS COMPANY. Tenders by Dec. 9.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer; not necessarily for publication, but as a proof of good faith.

COPY FOR ADVERTISEMENTS for the "JOURNAL" should be received at the Office NOT LATER than TWELVE O'CLOCK NOON ON MONDAY, to ensure insertion in the following day's issue.

Orders for Alterations in, or stoppages of, PERMANENT ADVERTISEMENTS should be received by the FIRST POST on SATURDAY.

Wanted, For Sale, and Tender Advertisements, Six Lines and under, 3s.; each additional Line, 6d.

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Telegrams: "GASKING, LONDON." Telephone: P.O. 1571a Central.

GAS COMPANIES' STOCK AND SHARE LIST.

Referred to on p. 591.

Issue	Share.	When ex Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
590,000	10	Oct. 14	10	Alliance & Dublin 10 p.c.	17–18	..	5 11 1
298,955	10	,,	7	Do. 7 p.c.	12½–13	..	5 7 8
310,000	Stk.	July 14	4	Do. 4 p.c. Deb.	100–102	+2	3 18 5
200,000	5	Oct. 28	6½	Bombay, Ltd.	5⅜–6	..	5 8 4
40,000	5	,,	6½	Do. New, £4 paid	4½–4¾	..	5 9 1
50,000	10	Aug. 26	15	Bourne- mouth Gas and Water } 10 p.c. B 7 p.c. Pref. 6 p.c.	28–28½	..	5 5 3
311,810	10	,,	7		16½–16⅝	..	4 3 7
75,000	10	,,	6		15½–15⅝	..	3 16 2
380,000	Stk.	Aug. 12	12½	Brentford Consolidated	253–256	..	4 17 8
300,000	,,	,,	9½	Do. New	190–192	..	4 19 0
50,000	,,	,,	5	Do. 5 p.c. Pref.	120–122	..	4 2 0
206,250	,,	June 11	4	Do. 4 p.c. Deb.	100–102	..	3 18 5
220,000	Stk.	Sep. 10	11	Brighton & Hove Orig.	208–213	..	5 3 3
246,320	,,	,,	8	Do. A Ord. Stk.	150–152	..	5 5 3
467,000	20	Oct. 14	10	British	42½–43½	+½	4 11 11
109,000	Stk.	Aug. 26	6	Bromley, A 5 p.c.	118–120	..	5 0 0
165,700	,,	,,	4½	Do. B 3½ p.c.	88–90	..	5 0 0
82,278	,,	,,	5½	Do. C 5 p.c.	106–108	..	5 1 10
55,000	,,	June 25	3½	Do. 3½ p.c. Deb.	88–90	..	3 17 9
500,000	10	Oct. 14	7	Buenos Ayres (New) Ltd.	13½–14	..	5 0 0
250,000	Stk.	June 25	4	Do. 4 p.c. Deb.	96–98	..	4 1 8
100,000	10	—	—	Cape Town & Dis., Ltd.	2½–3½	..	—
100,000	10	—	—	Do. 4½ p.c. Pref.	5⅛–5⅜	..	—
50,000	50	Nov. 2	6	Do. 6 p.c. 1st Mort.	47½–48½	..	6 3 9
100,000	Stk.	June 25	4½	Do. 4½ p.c. Deb. Stk.	82–84	..	5 7 2
157 153	Stk.	Aug. 12	5	Chester 5 p.c. Ord.	108½–110½	..	4 10 6
1,193,280	Stk.	Aug. 26	5⅝	Commercial 4 p.c. Stk.	109–111	..	4 13 8
560,000	,,	,,	5	Do. 3½ p.c. do.	104–106	..	4 14 4
475,000	,,	June 11	3	Do. 3 p.c. Deb. Stk.	81–83	..	3 12 3
800 000	Stk.	,,	5	Continental Union, Ltd.	97–99	..	5 1 0
200,000	,,	,,	7	Do. 7 p.c. Pref.	138–140	..	5 0 0
492,270	Stk.	—	5	Derby Con. Stk.	121–123	..	4 1 4
55,000	,,	—	4	Do. Deb. Stk.	103–105	..	3 16 2
148,995	,,	Oct. 2	5	East Hull 5 p.c. Ord.	97–99	..	5 1 0
486,090	10	July 14	12	European, Ltd.	24½–25	..	4 16 0
354,060	10	,,	12	Do. £7 10s. paid.	18½–19	..	4 14 9
15,141,545	Stk.	Aug. 12	4⅝	Gas light and Coke } 4 p.c. Ord. 3½ p.c. max. 4 p.c. Con. Pref. 3 p.c. Con. Deb.	102½–103⅜	..	4 10 1
2,600,000	,,	,,	3½		87–89	..	3 18 8
3,799,735	,,	,,	4		103–105	..	3 16 2
4,193,975	,,	June 11	3		82–84	..	3 11 5
258,740	Stk.	Sep. 10	5	Hastings & St. L. 3½ p.c.	92–94	..	5 6 4
82,500	,,	,,	6½	Do. do. 5 p.c.	117–119	..	5 9 3
70,000	10	Sep. 29	11	Hongkong & China, Ltd.	17½–17¾	..	6 4 0
131,070	Stk.	Sep. 10	6½	Ilford A and C	144–146	..	4 9 0
65,783	,,	,,	5	Do. B	108–110	..	4 10 11
65,500	,,	June 25	4	Do. 4 p.c. Deb.	102–104	..	3 16 11
4,940,000	Stk.	Nov. 11	8	Imperial Continental	175–177	–1	4 10 5
1,235,000	Stk.	Aug. 12	3½	Do. 3½ p.c. Deb. Red.	94–96	–1	3 12 11

Issue	Share.	When ex Dividend.	Dividend or Dividend & Bonus.	NAME.	Closing Prices.	Rise or Fall in Wk.	Yield upon Investment.
£			p.c.				£ s. d.
195,242	Stk.	Aug. 26	6	Lea Bridge Ord. 5 p.c.	119–121	..	4 19 2
561,000	Stk.	,,	10	Liverpool United A.	223–225	..	4 8 11
718,100	,,	,,	7	Do. B	166–168	..	4 3 4
306 083	,,	June 25	4	Do. Deb. Stk.	104–106	..	3 15 6
75,000	5	Nov. 26	6	Malta & Mediterranean	4⅜–5*	..	6 0 0
560,000	100	Oct. 1	5	Met of 5 p.c. Deb.	59–102	..	4 18 0
250,000	100	,,	4½	Melbourne } 4½ p.c. Deb.	100–102	..	4 8 3
541,920	20	Nov. 11	3½	Monte Video. Ltd.	12½–13	..	5 7 8
1,775,892	Stk.	July 29	4½	Newc'tle & G'tesh'd Con	106–108	..	4 3 4
518,795	Stk.	June 25	3½	Do. 3½ p.c. Deb.	93–94	..	3 14 6
55,940	10	Aug. 26	7	North Middlesex 7 p.c.	13–13½	..	5 3 8
300,000	Stk.	Nov. 26	8	Oriental, Ltd.	136–138*	..	5 15 11
60,000	5	Sep. 10	8	Ottoman, Ltd.	6⅞–7⅛	..	6 5 6
31,800	53	Aug. 26	13	Portsea Island A.	137–139	..	4 19 0
60,000	50	,,	13	Do. B.	129–131	..	4 19 3
100,000	50	,,	12	Do. C.	120–123	..	4 17 7
114,800	50	,,	10	Do. D and E.	101–103	..	4 17 1
398,490	5	Oct. 28	7	Primitiva Ord.	6¼–7⅛	–⅛	4 18 3
796,983	5	July 29	5	Do. 5 p.c Pref.	5⅛–5⅜	–⅛	4 13 0
488,903	100	June 1	4	Do. 4 p.c. Deb.	95–97	..	4 2 6
1,200,000	10	Oct 14	8	River Plate Ord.	16½–16⅝		4 15 7
312,650	Stk.	June 25	4	Do. 4 p.c. Deb.	97–99	+½	4 0 10
250,000	10	Sep. 29	8	San Paulo, Ltd.	14⅜–15	..	5 6 8
62,500	10	,,	6	Do. 6 p.c. Pref.	11⅝–12⅛	..	4 18 0
125,020	50	July 1	5	Do. 5 p.c. Deb.	51–52	..	4 16 2
135,000	Stk.	Sep. 10	10	Sheffield A	230–232	..	4 6 2
209,984	,,	,,	10	Do. B	230–232	..	4 6 2
523,500	,,	,,	10	Do. C	230–232	..	4 6 2
70,000	10	Oct. 14	10	South African	12⅛–12⅜	..	7 16 11
6,429,895	Stk.	Aug. 12	5⅓	South Met., 4 p.c. Ord.	119–121	–1	4 8 1
1,895,445	,,	July 14	3	Do. 3 p.c. Deb.	81–83	–1	3 12 3
209,820	Stk.	Aug. 26	8	South Shields Con. Stk.	156–158	..	5 1 3
605,000	Stk.	Aug. 12	5⅓	S'th Suburb'n Ord. 5 p.c.	119–121	..	4 10 11
60,000	,,	,,	5	Do. 5 p.c. Pref.	120–122	..	4 2 0
117,058	,,	July 14	5	Do. 5 p.c. Deb. Stk.	122–124	..	4 0 8
502,310	Stk.	Nov. 11	5	Southampton Ord.	09–111	..	4 10 1
120,000	Stk.	Aug. 12	6⅞	Tottenham and } A 5 p.c. B 3½ p.c.	131–135	..	5 1 9
453,940	,,	,,	5⅜		111–113	..	4 15 3
149,470	,,	June 25	4	Edmonton } 4 p.c. Deb.	100–102	..	3 18 5
182,380	10	June 11	8	Tuscan, Ltd.	9–9½	..	8 8 6
149,900	10	July 1	5	Do. 5 p.c. Deb. Red.	10–102	..	4 18 0
236,476	Stk.	Aug. 14	5	Tyn mouth, 5 p.c. max.	110–112	..	4 9 3
255,666	Stk.	Aug. 26	6⅝	Wands- worth } B 1½ p.c. 3 p.c. Deb. Stk.	139–141	..	4 14 0
79,416	,,	June 25	3		73–75	..	4 0 0
895,872	,,	Aug. 12	5⅜	West Ham 5 p.c. Ord.	123–125	..	4 6 0
210,000	,,	,,	5	Do. 5 p.c. Pref.	126–128	..	3 18 2
253,300	,,	June 25	4	Do. 4 p.c. Deb Stk.	108–110	..	3 12 9

Prices marked * are "Ex div."

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O'NEILL'S OXIDE
For GAS PURIFICATION.
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SPENT OXIDE PURCHASED IN ANY DISTRICT.

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Works: BIRMINGHAM, GLASGOW, LEEDS, LIVERPOOL, WAKEFIELD, AND SUNDERLAND.

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ALSO
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SULPHURIC ACID for Sale, specially suitable for making Sulphate of Ammonia.
BROTHERTON AND CO., LTD., Chemical Manufacturers, Works: BIRMINGHAM, LEEDS, WAKEFIELD, and SUNDERLAND.

J. & J. BRADDOCK (Branch of Meters Limited), Globe Meter Works, OLDHAM, and 54 & 47, Westminster Bridge Road, LONDON, S.E.
WET AND DRY GAS-METERS, PREPAYMENT METERS, STATION METERS, AND GOVERNORS.
REPAIRS RECEIVE PROMPT ATTENTION.
Telephones: 815 Oldham, and 2412 Hop, London.
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"BRADDOCK, OLDHAM," and "METRIQUE, LONDON."

OXIDE OF IRON (BOG ORE).
ANY QUANTITY. ANY PORT. ANY STATION.
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BENZOL
AND
CARBURINE FOR GAS ENRICHING.
ALSO
THE MAXIM PATENT CARBURETTOR.
For Prices, &c., apply to
THE GAS LIGHTING IMPROVEMENT CO., LTD.,
7, BISHOPSGATE STREET WITHOUT,
LONDON, E.C.
Telegraphic Address: "Carburine, London."

"GAZINE" (Registered in England and Abroad). A radical Solvent and Preventative of Naphthalene Deposits, and for the Automatic Cleaning of Mains and Services.
It is also used for the enrichment of Gas.
Manufactured and supplied by C. BOURNE, West Moor Chemical Works, KILLINGWORTH, or through his Agent, F. J. NICOL, Pilgrim House, NEWCASTLE-ON-TYNE.
Telegrams: "DORIC," Newcastle-on-Tyne. National Telephone No. 2497.

GAS OILS.
MEADE-KING, ROBINSON, & CO.
Represent the Strongest Independent Refineries in America; also Petroleum Spirit for Gas Enrichment. 18, EXCHANGE STREET, MANCHESTER, and 11, OLD HALL STREET, LIVERPOOL.

SULPHURIC ACID.
SPECIALLY prepared for Sulphate of AMMONIA Makers by
CHANCE AND HUNT, LIMITED,
Works: OLDBURY, WEDNESBURY, AND STAFFORD.
Address Correspondence and Inquiries to OLDBURY, WORCS.
Telegrams: "CHEMICALS, OLDBURY."

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GAS APPARATUS MANUFACTURER AND CONTRACTOR.
Telegrams: "GASOSO LONDON." Telephone: 14 HAMMERSMITH.

AMMONIACAL Liquor wanted.
CHANCE AND HUNT, LTD., Chemical Manufacturers, OLDBURY, WORCS.
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SPENCER'S PATENT HURDLE GRIDS.
THE very best Patent Grids for Holding Oxide Lightly.
See Illustrated Advertisement, Nov. 2, p. 357.

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4, EAST INDIA AVENUE,
LEADENHALL STREET, LONDON.
Telegraphic Address: "FITZMAURICE, LONDON." Telephone: No. 11,113 CENTRAL.
Established 1887.
Advertiser, who is Shipping Agent to several Gas Companies, Municipalities, and Gas Material Makers, would be glad to undertake SHIPMENT OF GOODS ordered by Colonial Gas-Works or Others.

GEO. NEWTON, Limited,
Wires: "AUTOMATIC, MANCHESTER."
40 YEARS' REPUTATION.
WET, DRY, ORDINARY and PREPAYMENT, STATION METERS, &c.
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OXIDE OF IRON.
(NATURAL.)
SPENT OXIDE PURCHASED.
BALE'S FIRE CEMENT.
PAINT FOR GAS-WORKS.
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We guarantee promptness, with efficiency for Repairs.
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Apply, THOMAS HORROCKS
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Pitch. Creosote, Brick and Fuel Oils, Benzol, Solvent Naphtha, Carbolic, Sulphate of Ammonia.

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RETORT SETTINGS, COAL-TESTING PLANT, BOILER FIRING.
UNDERWOOD HOUSE, PAISLEY.

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SIMULTANEOUS Discharging-Charger.
The one Machine which Discharges and Charges at One Stroke.
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THE G. J. Eveson Coal and Coke Company, Limited, Birmingham, will be glad to receive OFFERS of GAS COKE free into Trucks on Rail from Gas Companies having Surplus Quantities for Disposal.

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DO you appreciate how much success depends on well-considered and lucid presentment of your qualifications? I make a Speciality of the preparation of Applications, and am continually receiving Complimentary Letters from clients.
Write now for Particulars.
HERBERT GREATOREX, Hackney, MATLOCK.

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YOUNG Lady, daughter of a Gas Engineer, is desirous of meeting with a Situation as HOUSEKEEPER or any Position of Trust in a Family.
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DRAUGHTSMAN wanted well up in Coal and Coke Handling Plants, and Structural Work in Connection with Gas-Works.
Apply, stating Age, Experience, and Wages required, to W. J. Jenkins and Company, Limited, Engineers, Retford.

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REQUIRED, Experienced and Reliable Man for FOLLOWING UP important Inquiries.
Apply, by letter, giving full Information regarding Qualifications, including Age, Experience, &c., to No. 5159, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

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FAZAKERLEY GAS-WORKS.

WANTED, a Working Manager. Applicants must be good Carbonizers, thoroughly Experienced, and able to perform the usual Works Routine, together with keeping ordinary Gas-Works Day-Books, and have practical knowledge of Main and Service Laying and Internal Gas-Fitting; also able to read Gas-Meters, as well as Advise Gas Consumers.
Capacity of Works, about 20,000,000 Cubic Feet per Annum.
Salary, £100 per Annum, with House, Coal, and Gas free.
Applications, endorsed "Working Gas Manager," to be addressed to the Town Clerk, Municipal Offices, Liverpool, and must be received not later than the 13th of December next.

IMPORTANT.

INVERTED GAS-BURNERS.

WELL-KNOWN Makers, just bringing out an Improved Burner of First-Class Quality for Indoor and Outdoor Lighting, are desirous of receiving APPLICATIONS from Wholesale and Export Houses WILLING TO PUSH SALE. Firms able to Guarantee a large Turnover will have Preference, and will receive every facility. Illustrated Catalogue just ready for Distribution.
Apply to Principals, No. 5158, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

GASHOLDERS—Splendid, 45 feet diameter, and New STEEL TANK fixed complete, to Plan and Specification. Also 50 feet Single-Lift and 50 feet Double-Lift. Cheap, with STEEL TANKS. Can be seen temporarily erected.
Firth Blakeley's, Thornhill, Dewsbury.

PIPES—Stock of 4-inch Cast-Iron Spigot and Socket PIPES at Manchester (new). Coated with Dr. Smith's Composition. Special Low Price to Clear.
Address No. 5157, care of Mr. King, 11, Bolt Court, Fleet Street, E.C.

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IMPORTANT SALE OF FREEHOLD GAS-WORKS, &c., &c.

TO be Sold by Private Contract from the 31st of December next, as a Going Concern all that Valuable Property known as the "NORTH TAWTON GAS-WORKS, &c.," including all Stock-in-Trade, Mains, Services, Meters, 27 Public Lamps, 16 Stoves on Hire, and Three others in Stock, Piping and other Gas Requisites, with all Gas, Coal, Coke, and Tar remaining on the Premises at that date.
Further Particulars may be obtained from the owner Mr. Henry Gibbings, North Tawton, to whom Sealed Tenders should be sent on or before the 20th of December next.

SHOTLEY BRIDGE AND CONSETT DISTRICT GAS COMPANY.

TENDERS FOR TAR.

THE Directors of this Company invite TENDERS for the Purchase of the TAR produced at their Works from the 1st of January to the 31st of December, 1910. Quantity about 80,000 Gallons. Contractor to find his own Casks, and to accept Delivery at Blackhill Station.
Tenders to be sent to the undersigned, not later than Thursday, Dec. 9, 1909.

M. Richley,
Secretary.

Gas Offices, Front Street,
Shotley Bridge.

RADCLIFFE AND PILKINGTON GAS COMPANY.

SPENT OXIDE.

THE Directors of this Company invite TENDERS for the Purchase of about 200 Tons (more or less) of SPENT OXIDE.
Samples for Testing may be taken from the heap by any intending Purchaser, or will be sent, together with Particulars, on Application to the undersigned.
Tenders will be received until Friday, the 3rd of December.

James Braddock,
Manager and Secretary.

Gas-Works, Radcliffe,
Manchester, Nov. 25, 1909.

CORPORATION OF NOTTINGHAM.
(Gas Department.)

TENDERS FOR THE SUPPLY OF GOODS AND MATERIALS.

THE Gas Committee are prepared to receive TENDERS for the Supply of the Whole or a Portion of their Requirements of the following GOODS and MATERIALS, for delivery during the ensuing Year, Carriage Paid, at their various Gas-Stations, Chemical Works, or Stores, or at any Railway Station within the Nottingham Gas Supply District:—

(*a*) Cast-Iron Pipes and Specials.
(*b*) Pig Lead, Lead and Compo. Pipe, White, Red, and Chemical Sheet Lead.
(*c*) Wrought Iron and Steel.
(*d*) Retorts and Fire Materials.
(*e*) Meters (Wet and Dry, and Prepayment); also Repairs.
(*g*) Brass Cocks, and Malleable Iron Levers.
(*h*) Small Iron Castings, Retort Fittings, &c.
(*i*) Purchase of old Cast and Wrought Scrap Iron, Old Copper, Brass, &c.
(*j*) Lime for Chemical Works purposes.
(*k*) Paints.
(*l*) Oils.
(*m*) Rope Yarn.
(*n*) Tallow, &c.
(*o*) Cotton Waste.
(*p*) Coke Forks, Shovels, Buckets, Files, &c.
(*q*) Meter Boxes, Platforms, and Shelves.
(*r*) Timber.
(*s*) Plumbing.
(*t*) Tools for Distribution Department.

Specifications and Forms of Tender may be obtained and Samples seen on Application to the Engineer and General Manager, at the Gas Offices, George Street, Nottingham.
Tenders to be addressed to me and delivered at the Guildhall, Nottingham, not later than Saturday, the 4th of December, 1909.
The Gas Committee do not bind themselves to accept the lowest or any Tender.

By order,
J. A. H. Green,
Town Clerk.

Guildhall, Nottingham,
Nov. 23, 1909.

SALES BY AUCTION OF GAS AND WATER STOCKS AND SHARES.

MESSRS. A. & W. RICHARDS beg to notify that their SALES BY AUCTION of NEW CAPITAL ISSUED UNDER PARLIAMENTARY POWERS, and of STOCKS and SHARES belonging to EXECUTORS and other PRIVATE OWNERS in LONDON, SUBURBAN, and PROVINCIAL GAS and WATER COMPANIES, take place PERIODICALLY at the Mart, TOKENHOUSE YARD, E.C.
Terms for Issuing New Capital, and also for including other Gas and Water Stocks and Shares in these Periodical Sales, will be forwarded on Application to Messrs. A. & W. Richards, at 18, Finsbury Circus, E.C.

By order of the Directors of the
SOUTHEND WATER-WORKS COMPANY.

NEW ISSUE OF 500 NEW ORDINARY FIVE PER CENT. MAXIMUM £10 SHARES
AND
£5000 FOUR PER CENT. PERPETUAL DEBENTURE STOCK.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Dec. 7, at Two o'clock, in Lots.
Particulars of the Auctioneers, 18, Finsbury Circus, E.C.

By order of the Directors of the
HARROW AND STANMORE GAS COMPANY.

NEW ISSUE OF 500 £10 "C" SHARES.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Dec. 7, at Two o'clock, in Lots.
Particulars of the Auctioneers, 18, Finsbury Circus, E.C.

LOWESTOFT WATER AND GAS COMPANY.

45 £10 ORDINARY TEN PER CENT. SHARES
AND
47 £10 ADDITIONAL ORDINARY SEVEN PER CENT. SHARES.

MESSRS. A. & W. RICHARDS will SELL THE ABOVE BY AUCTION, at the Mart, E.C., on Tuesday, Dec. 7, at Two o'clock, in Lots.
Particulars of the Auctioneers, 18, Finsbury Circus, E.C.

BRENTFORD GAS COMPANY.

SALE BY TENDER OF £30,000 NEW STOCK, 1881.

IN pursuance of the Brentford Gas Order, 1881, Notice is Hereby Given, that it is the intention of the Directors of this Company to SELL BY TENDER £30,000 of NEW STOCK, 1881, of the Company, to be paid up in full on or before the 15th day of January, 1910; such Stock being a portion of Additional Capital Authorized to be raised by Resolutions passed at an Ordinary Meeting of the Proprietors held on the 11th day of February, 1898, under the powers of the above-mentioned Order.
Particulars and Conditions of Tender may be obtained on Application at this Office; and Sealed Tenders must be sent in not later than Ten o'clock on the Morning of Wednesday, the 15th day of December next.

By order,
William Mann,
Secretary.

Office: Brentford Gas Company,
Brentford, Nov. 1, 1909.

THE GASLIGHT AND COKE COMPANY.

NOTICE is Hereby Given, that the TRANSFER BOOKS of this Company, so far as they relate to DEBENTURE STOCK and BONDS, WILL BE CLOSED at Four o'clock p.m., on Friday, the 10th prox., for the Half Year ending on the 31st prox., and WILL BE RE-OPENED on the Morning of Saturday, the 11th prox.
The Interest for the Half Year will be payable on the 1st of January next to the Proprietors registered on the closing of the Books.

By order,
Henry Rayner,
Secretary.

Chief Office: Horseferry Road,
Westminster, S.W., Nov. 26, 1909.

Price 5s. 6d. Post Free.

REPORTS OF DISTRICT GAS ASSOCIATIONS FOR 1908.

London: Walter King, 11, Bolt Court, Fleet St., E.C.

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MIRFIELD GAS COAL.
UNEQUALLED.
Sperm Value 878·85 lbs. per Ton.

Please apply for Price, Analysis, and Report, to the

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LONDON: 16, Park Village East, N.W.

LUX'S Gas Purifying Material

is now used in many Gas-Works throughout Scotland with gratifying success.

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Ludwigshafen-am-Rhein

Sole Agent for Scotland:
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Telegrams: "GASLUX, EDINBURGH"

Descriptive Pamphlet on Application.

TROTTER, HAINES, & CORBETT,
BRETTELL'S ESTATE, LIMITED,
FIRE-CLAY & BRICK WORKS,
STOURBRIDGE.

Manufacturers of GAS RETORTS, GLASSHOUSE FURNACE & BLAST-FURNACE BRICKS, LUMPS, TILES, and every description of FIRE-BRICKS.
Special Lumps, Tiles, and Bricks for Regenerative and Furnace Work.
SHIPMENTS PROMPTLY AND CAREFULLY EXECUTED.

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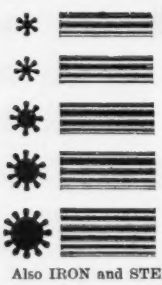
THOMAS DUXBURY & CO.,
16, DEANSGATE, MANCHESTER.
Best Gas Coal and Cannel, giving High Illuminating Power, Large Yield per ton, and reasonable in Price.
Telegrams: "DARWINIAN, MANCHESTER."
Telephone 1806.


BRASS AND STEEL PINION WIRE
any lengths.
John Rigby & Son, LTD.,
Rawfolds Wire Mills,
CLECKHEATON.
Also IRON and STEEL WIRE of all descriptions.

HEATHCOTE GAS COAL
from the
GRASSMOOR COLLIERIES,
CHESTERFIELD.
Rich in Illuminating Power and Yield of Gas.
Above the Average in Weight and Quality of Coke.
Maintains a High Standard in Residuals.

'BUFFALO' INJECTOR
Operated Entirely by One Handle.
Class A lifts 24 ft.
Class B lifts 12 ft.

SEND FOR LIST.
Telegrams: "Temperature London." Tel. No. 12,455 Central.
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JOHN HALL & CO. OF STOURBRIDGE,
LIMITED,
STOURBRIDGE,
Manufacturers of
FIRE-BRICKS, LUMPS, TILES,
GAS RETORTS,
And every description of Fire-Clay Goods.
RETORTS CAREFULLY PACKED FOR SHIPMENT.

JAMES OAKES & CO.,
ALFRETON IRON-WORKS, DERBYSHIRE,
AND
Wenlock Iron Wharf, 21 & 22, Wharf Road, CITY ROAD, LONDON, N.
Manufacture and keep in Stock at their Works (also large Stock in London)
PIPES and CONNECTIONS, 1½ to 48 inches in diameter, and make and erect to order RETORTS, PURIFIERS, and TANKS, with or without planed joints, COLUMNS, GIRDERS, SPECIAL CASTINGS, &c., required by Gas, Water, Railway, Telegraph, Chemical, Colliery, and other Companies.
NOTE.—Makers of HORSLEY SYPHONS. These are cast in one piece, without Chaplets; doing away with Bolts, Nuts, and Covers, and rendering Leakage impossible.

NEW EARTH BORERS.
15 Patents. Highest Awards.
Work easily and quickly. Reliable.
For Earth-Working, Boring, Soil-Testing, Planting, Sinking Fences, Posts, and various other uses.
Borers from 60 to 400 mm. (2⅜ in. to 16 in.) diameter.
Great Saving of Labour. Low Prices
Catalogue Gratis.
E. JASMIN,
Hamburg 30. Lehmweg 30.

NEWBATTLE CANNEL.
Highest Results in Gas, & Excellent Coke.
QUOTATIONS ON APPLICATION TO
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LIMITED,
NEWBATTLE COLLIERIES,
NEWTONGRANGE, MIDLOTHIAN.

THOMAS TURTON AND SONS, LIMITED,
SHEAF WORKS, SHEFFIELD,
MANUFACTURERS OF
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FOR ENGINEERS.
STEEL OF ALL DESCRIPTIONS.
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THE
EARLIEST WORKS ON GAS LIGHTING.
A List of Books, Pamphlets, and Important References prior to the Year 1840.
By F. SOUTHWELL CRIPPS, Assoc.M.Inst.C.E.
LONDON: WALTER KING, 11, BOLT COURT, FLEET ST., E.C

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LIME & OXIDE ELEVATORS & CONVEYORS.
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STAMPED AND RIVETED STEEL ELEVATOR BUCKETS.
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COKE is selling at . . . **11s. 8d.** a Ton
COALEXLD is selling at . **20s. 0d.** a Ton
IN THE SAME TOWN.
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COALEXLD LTD., LANCASTER.

Special Pressure and Pressure & Exhaust Registers.
For RETORT-HOUSE GOVERNORS.
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For OFFICES AND DISTRICTS.
Fullest particulars on application to—
T. G. MARSH,
28, Deansgate, MANCHESTER.

GRAETZIN LIGHT

Important Improvements.

BURNERS.

1. **20-Candle Power more light** without increase in the consumption of gas.
2. **Patent Gas Adjuster;** cannot get out of order.
3. **Automatic Gas Regulator,** ensures a constant and unvarying pressure of 35 mm., guarantees a steady light, at the same time obviating waste of gas and blackening of the burner.
4. **Accurate Regulation of the Air Supply.**
5. Burners will be supplied either with Gas Adjuster or Automatic Gas Regulator.
6. The brass casing is heatproof, and, if occasionally cleaned with warm water, will not become discoloured.

LAMPS.

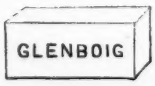
From Lamps with more than one burner, the injectors can be removed from the outside, without taking the lamps to pieces.

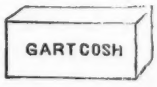
THE GLENBOIG UNION FIRE-CLAY CO., LTD.

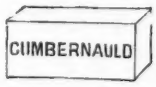
GLENBOIG FIRE-BRICKS AND GAS-RETORTS.

Every Genuine Glenboig Brick, Block, Gas-Retort, &c., is legibly stamped with one or other of the Glenboig Company's Registered Trade Marks, as here shown.

TRADE MARKS.



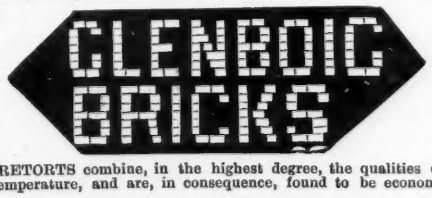




The Glenboig Trade Marks are imitated, and the Glenboig Name unfairly used by Makers of a lower Class of Goods, which, when sold under their own name, command much lower prices.
The Genuine Brand, Stamped on the Goods, is the only Reliable Guarantee to the Purchaser.

GAS-RETORTS, FIRE-BRICKS, BLOCKS, &c., &c.

The SPECIAL BRICKS used in the Construction of Gas Furnaces for Heating Retorts.



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Offices: 48, West Regent St., Glasgow.

56 Prize Medals and Diplomas of Honour.
Highest Award wherever exhibited.

The GLENBOIG BRICKS, BLOCKS, AND RETORTS combine, in the highest degree, the qualities of not melting, and not splitting, when subjected to the highest heats and most sudden changes of temperature, and are, in consequence, found to be economical, even in districts where the local bricks can be had at half the price.

Undernoted we give a Table of Analysis and Physical Characteristics of a sample of Glenboig Fire-Clay by J. T. Norman, London; and, in submitting a report from a responsible and reliable public analyst, we would here draw attention to the unreliable character of some recently published analysis where a manufacturer selects not only his own samples, but also those of his competitor, and has them treated by a private analyst. SUCH STATEMENTS ARE ALTOGETHER UNTRUSTWORTHY.

ANALYSIS OF GLENBOIG FIRE-CLAY.

By JOHN T. NORMAN, Esq., F.C.S., &c., The City Central Laboratory, LONDON.

THE GLENBOIG UNION FIRE-CLAY CO., LTD., GLENBOIG, SCOTLAND.

23, LEADENHALL STREET,
LONDON, E.C., September 21st, 1909.

DEAR SIRS,

I have completed the investigation of the samples of Clay received from you on the 10th inst., and now beg to report the results.

CHEMICAL ANALYSIS.

	Raw.	Fired.
Silica, free	3·03	3·49
Silica, combined	43·20	49·77
Alumina	36·55	42·10
Ferric oxide	1·80	2·08
Titanic oxide	1·30	1·50
Lime	trace	trace
Magnesia	trace	trace
Alkaline oxides	trace	trace
Sulphates as trioxides	0·92	1·06
Loss on Ignition	13·20	—
	100·00	100·00

PHYSICAL RESULTS.

Density	2·65
Volume weight	1·90
Porosity	15·4 %
Linear shrinkage at 1000° C.	3·70 %
" " 1050° C.	4·76 %
" " Total	8·46 %
Volume shrinkage at 1000° C.	10·7 %
" " 1050° C.	12·6 %
" " Total	23·3 %
Plasticity	20·0 %
Fire Stability	1850° C. equiv. to 3362° F.

(SEGER CONE 36.) (New Scale CONE 38.)

(Signed) J. T. NORMAN.

This Clay is remarkable for its high percentage of Alumina and for the almost complete absence of ingredients tending to lower the refractory properties; its fire stability is extremely high. For some years past I have been urging clients who are working the Clays of the Coal Measures to search for such a material, but you are the first to discover a supply. The possession of this Clay places you in a unique position amongst the manufacturers of refractory goods throughout the world, and I have no doubt will, if duly exploited, enable you to drive out of the market the large quantities of foreign fire-bricks which are being poured into this country for use in the construction of bye-product ovens and for other purposes.—I am, yours faithfully,

JOHN T. NORMAN.

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Aggregate Capacity of Plants supplied
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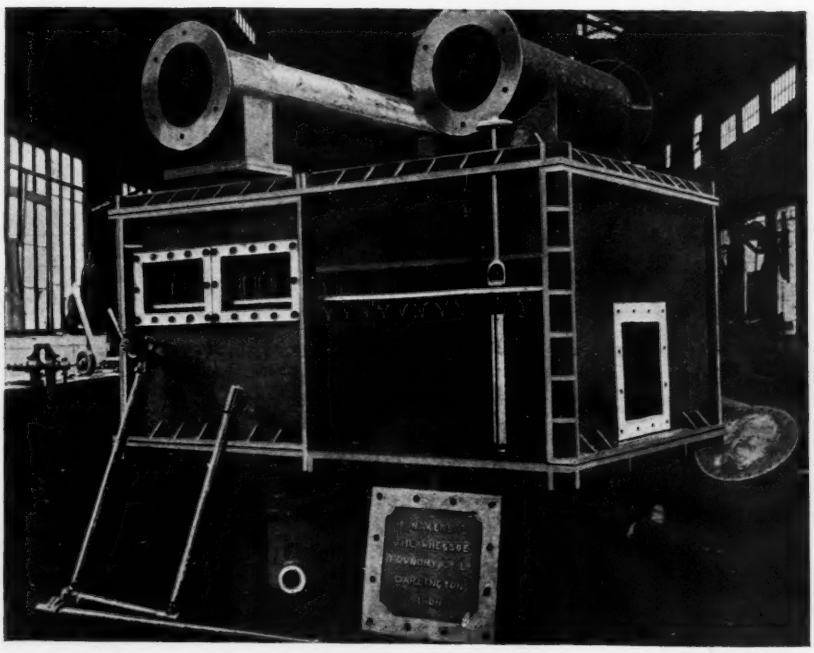

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Construction of

Entire Gas-Works & Coke Oven Plants,

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With and without Recovery of the Bye-Products, Tar and Benzol Distilleries, Ammonia Works, and Cyanogen Extraction Plants.

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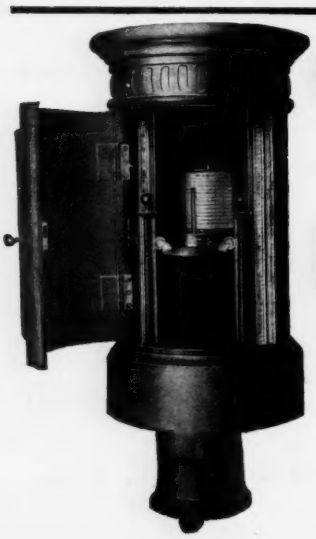

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FOR

Ordinary or High Pressure.

PILLAR BOX contains Air-Pressure Holder for Loading the Governor from a distance also Recording Gauge and Inlet and Outlet Pressure Gauges.

LARGE MERCURIAL GOVERNOR.
From a Photo. of 24 in. Size.
May be Loaded by Weights or Air Pressure from a Distance.

Welsbach
LIGHT
Inverted Arc Lamp, Fig. 623.

Storm Proof—
For Exterior Lighting.

Welsbach-Kern
(Patent) Inverted System

BRITISH MADE.

BRITISH MADE.

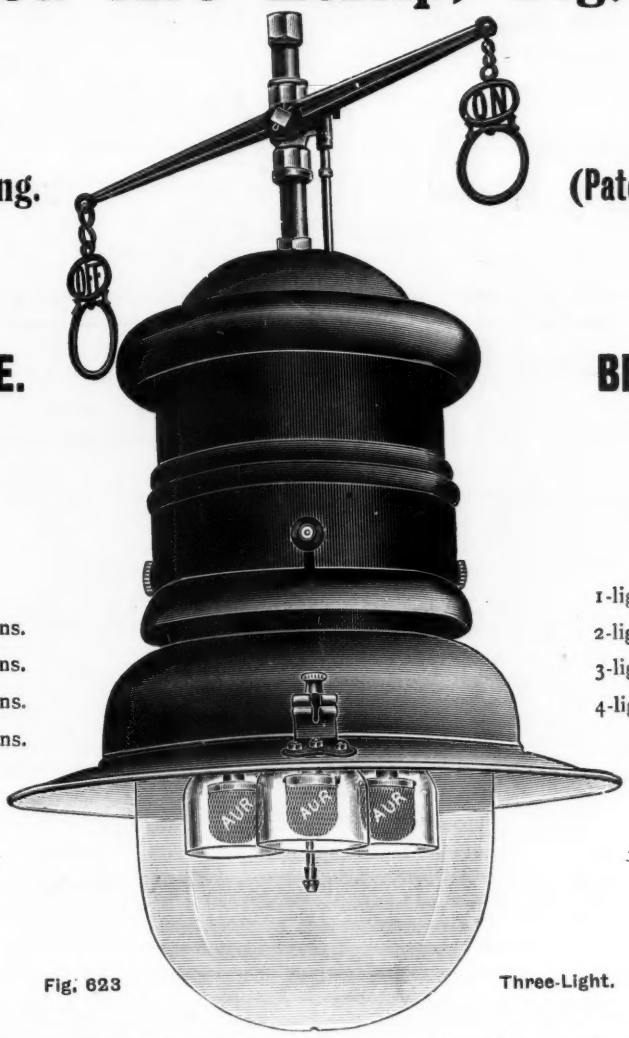

Fig. 623 Three-Light.

Height over all.

1-light . . .	1 ft. 8 ins.
2-light . . .	2 ft. 4 ins.
3-light . . .	2 ft. 4 ins.
4-light . . .	2 ft. 7 ins.

Width over all.

1-light . . .	1 ft. 1 in.
2-light . . .	1 ft. 5 ins.
3-light . . .	1 ft. 5 ins.
4-light . . .	1 ft. 8 ins.

ENAMELLED Green Steel Casing, fitted with Welsbach-Kern Inverted Burners, Gas and Air Regulators operated from outside. Sliding Door to give access to Burners for cleaning purposes. Fitted with Magnesia Nozzles, Welsbach Mantles, and Glass Mantle Protectors. Complete as shown. Highly efficient and regenerative.

	Gas per hour.	*C.P.*	*Steel.*	*Copper Case.*		*Gas per hour.*	*C.P.*	*Steel.*	*Copper Case.*
1-light	4 feet	125	**30/-**	**5/-** extra.	3-light	12 feet	400	**52/6**	**6/-** extra.
2-light	8 feet	260	**47/6**	**6/-** extra.	4-light	16 feet	550	**72/6**	**9/-** extra.

All on or off, or One light on and the rest off, **7/6** per Lamp extra. Cup and Ball, **3/6** per Lamp extra.

RENEWALS.

Glass Mantle Protectors (Fig. 623) **3/4½** per dozen, or in case lots of 5 gross, **33/-** per gross.

	1-Light.	*2-Light.*	*3-Light.*	*4-Light.*
Clear Glass Globes, each	**2/3**	**5/9**	**5/9**	**9/-**
" " " In Case lots per dozen.	**19/6**	**57/9**	**57/9**	**93/-**
Case contains . .	*80*	*18*	*18*	*12*

	1-Light.	*2-Light.*	*3-Light.*	*4-Light.*
Wired Globes, extra each	**2/-**	**2/-**	**2/9**	**3/6**
Parabolic Reflector, extra "	**3/6**	**6/-**	**7/6**	Not made

Welsbach Mantles, each **6d.** subject as usual.

The Welsbach Mantles for Upright lighting are "C," "CX," and "Plaissetty," price **4½d.** each.

THE WELSBACH INCANDESCENT GAS LIGHT CO., LTD.,
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Telegrams and Cables: "WELSBACH LONDON." *Telephone 2410 NORTH.*

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Are the exclusive Owners of the well-known HAIGH HALL & KIRKLESS HALL GAS COAL COLLIERIES, Wigan, and of the Manton Steam and House Coal Collieries, Worksop, Notts, and supply the well-known Wigan Arley Mine Gas Coal, Gas Nuts, Gas Cannel, Cannel Nuts, House and Steam Coals, &c.

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CARBONIZATION MADE EASY.

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Carbonizing charges **40 per cent. less** than with Horizontals.
No skilled Stokers necessary.
Yield of Gas per ton guaranteed about 1000 cubic feet more than under present conditions, of guaranteed candle power.
Heats under absolute control throughout the whole length of the Retorts.
Saleable value of Coke greatly increased.
25 per cent. greater yield of Ammonia.
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Stopped Pipes unknown.
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45 per cent. less ground space required.
Constructional cost per Ton carbonized considerably less than with Horizontal or Ordinary Inclined Retorts.
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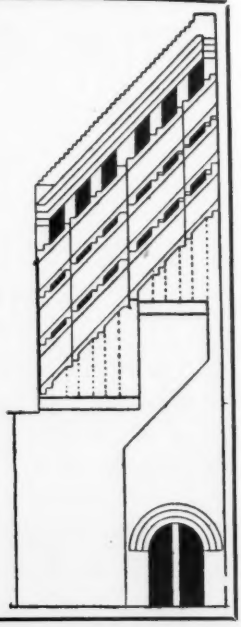

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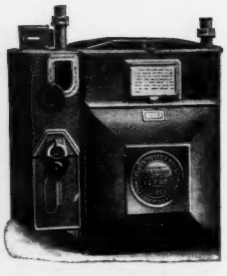

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Undoubtedly the Finest and Best Preparation on the Market for **quickly** removing Burnt Grease from the Enamelled Lining of Cookers and Cleaning Lantern Reflectors is

Clarks "GASCOLITE."

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Can either be applied with a Brush, allowed to stand, Cold, for a few hours, or with Heat for about Half-an-Hour, when Liners and Reflectors can be washed off with Hot or Cold Water and will appear as **new,** or, **put into Tanks** with **Boiling Water,** when Liners and Reflectors will be cleaned in about 20 Minutes.

In cases where a **steam pipe** is connected to bottom of tank, stoves or liners can be **perfectly cleaned** in 5 to 10 minutes.

This Result can only be obtained at **lightning speed** by using **"Gascolite."**

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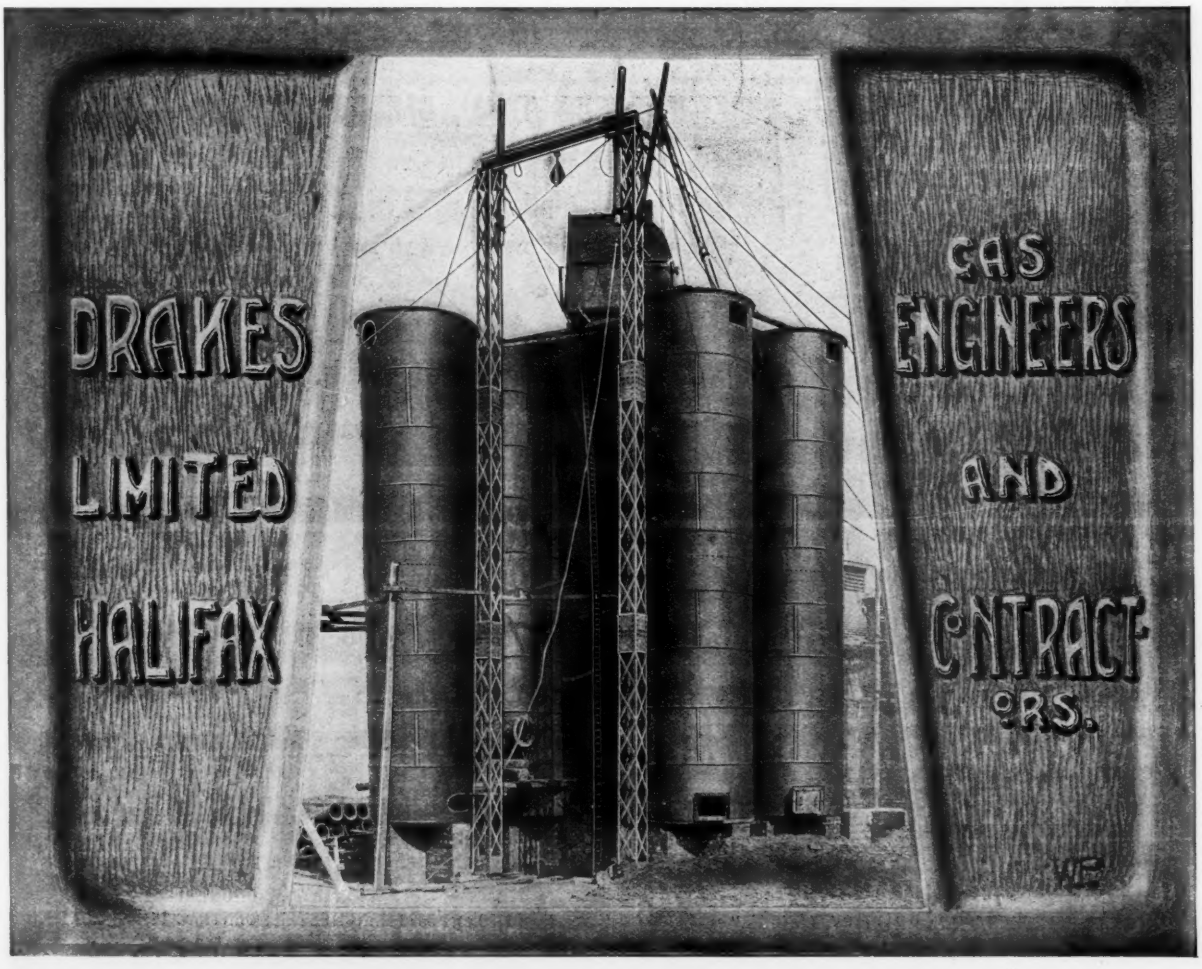

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DURHAM (THORNLEY) COAL.

Gas made per Ton	13,102	cubic feet.
Fuel Consumption	12·3	lbs. per cent.
Illuminating Power	15·56	No. 2 Met. Burner.
Calorific Value	573·6	B.Th.U. (Gross).

YORKSHIRE (SILKSTONE), BARROW COLLIERY.

Gas made per Ton	12,435	cubic feet.
Fuel Consumption	13·4	lbs. per cent.
Illuminating Power	16·19	No. 2 Met. Burner.
Calorific Value	584·9	B.Th.U. (Gross).

LANCASHIRE, WIGAN (ARLEY MINE).

Gas made per Ton	12,145	cubic feet.
Fuel Consumption	12·2	lbs. per cent.
Illuminating Power	15·22	No. 2 Met. Burner.
Calorific Value	576·2	B.Th.U. (Gross).

See "JOURNAL OF GAS LIGHTING," June 8 & July 20, 1909, for description and results.

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Printed and Published by WALTER KING, at No. 11, BOLT COURT, FLEET STREET, in the CITY OF LONDON.—Tuesday, Nov. 30, 1909.